AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

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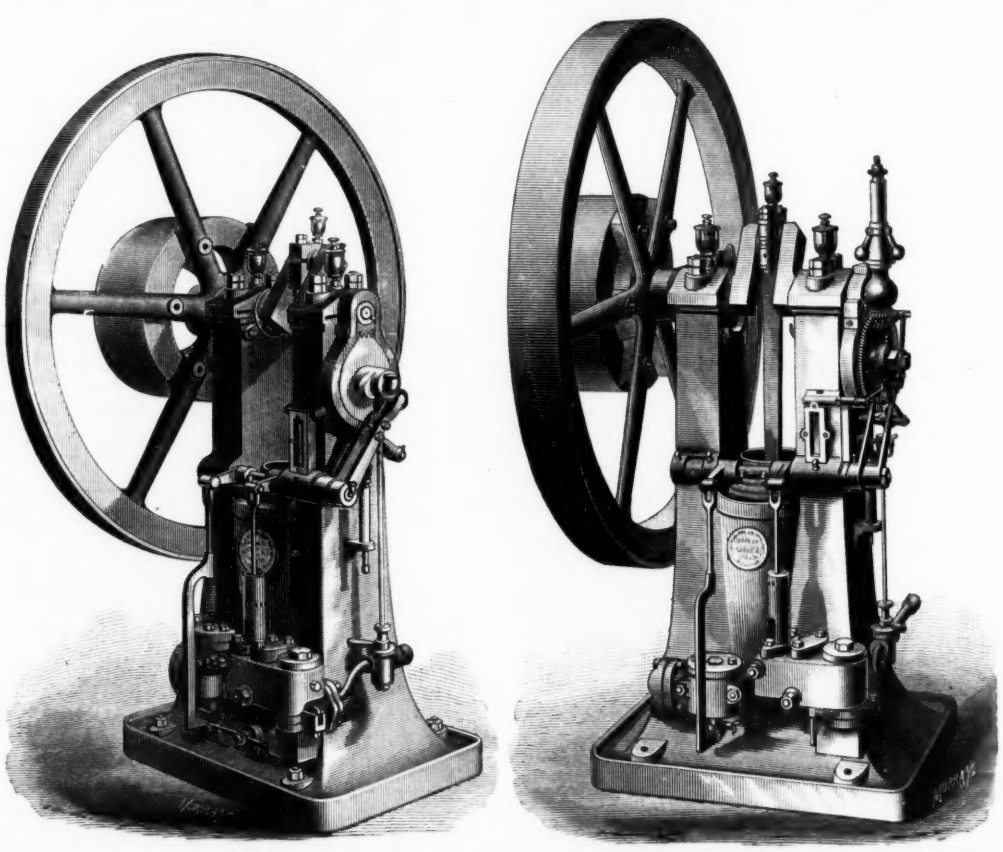
New Design of the Korting Gas Engine.

Prominent features of the new design of the Korting gas engine, which is illustrated on pages 1 and 2, are simplicity, compactness, and convenience of access to working parts.

The inlet and exhaust valves are provided with covers having ground joints, and held in place by a single screw, which may be quickly released, exposing all working parts of the valves, and again replaced by any person, without possibility of derangement.

The igniter is simple, accessible in all its parts, and appears to be very complete in its operations. The various mechanical movements requiring adjustment are provided with approved appliances for such purposes. The appliances for oiling and preventing parts from becoming overheated are excellent in their details and automatic in action.

The leading features of the governor are two independent movements derived from the main shaft. The first is for uniformly opening the exhaust valve; the second is influenced by the speed, and varies the time of closing this valve. It is easy to understand that the power of the engine may be influenced by the length of time the exhaust valve is kept open during the return stroke of the piston; the earlier the valve is closed the larger the quantity of the products of combustion retained in the cylinder, and the smaller the amount of fresh gases required to again fill the cylinder, to secure uniform compression and a combustible mixture for the next working stroke of the engine. Thus the minimum power is secured by retaining in the cylinder the larger portion of residuum, and taking in the smallest amount of fresh gases, and the maximum of power by expelling the greater portion of the residuum and again filling the cylinder with fresh gases. Between these two extremes all medium degrees of power are secured by the action of the governor closing the exhaust valve at various points between the two extremes of the stroke of the piston.



NEW DESIGN OF KORTING GAS ENGINE.

This system of governing is, we believe, peculiar to the Korting gas engine. It is claimed that the heated residuum retained occupies the highest position in the cylinder, and that the cold fresh gases which are drawn in below will retain the lowest position in a separate strata, hence by the action of the inlet or mixing valve, which admits the gases in the correct proportions, just the desired amount of gases for the work required is admitted, and in just the condition to explode.

It is well known that different gases require different volumes of oxygen for their perfect combustion. The Korting mixing valve is so constructed that it may be adjusted to admit any desired proportion of gas with the required volume of air, thus adapting the engine to use different qualities of gas to the best advantage as regards economy of combustion.

Figs. 1 and 2, page 2, show the action of the valve mechanism in the form in which it is applied to larger engines, the same principle applying, however, to both large and small engines.

The cam *F*, Fig. 1, opens the exhaust valve by coming in contact with the roller *R*, which is in the end of the lever *E*. This lever in its turn actuates the lever *D*, which connects to the exhaust valve stem *B*. It will thus be seen that the exhaust valve would be opened and closed by the combined action of the cam *F* and the spiral spring *C*, the position of the lever *C* determining the time of closing. The lever *G* is swung back and forth by the action of the eccentric *S* and the spiral spring *N*, and when the governor is acting the projection *H* upon this lever engages with the hook upon the end of the valve stem and holds the exhaust valve open. The governor *M* acts through the lever *O* and the link *P* upon the cam *I*, and by raising and depressing it alters the position of the lever *G*, and consequently the time of closure of the exhaust valve; this closure taking place whenever the lever *G* releases the hook *B*, allowing the spring *C* to close the valve.

Fig. 2 is simply a variation of the same mechanism, in which the action is the same, except that the cam *I* is replaced by the wedge, as shown.

Of course it will be understood that the cuts are only outline, or skeleton figures, intended to show the action of the mechanism, and not its actual detailed construction.

From this description it will be seen that if the speed of the engine is increased, the governor, by depressing the cam or eccentric quadrant *I*, increases the distance between the eccentric and the pivot *J*, thus causing the point of release to be reached earlier in the stroke, with a corresponding early closure of the exhaust.

Fig. 3, page 2, shows the construction of the governor and valve mechanism as it is applied to engines of the kind shown upon page 1, in which the mechanical construction only is different, the principle being the same.

The manufacturers are the Korting Gas Engine Co., Limited, 60 Barclay street, New York.

Of 28 boiler explosions in November last, reported in the *Locomotive*, 13—nearly half—were sawmill boilers.

W. B. Thompson, Dundee, Scotland, recently launched a steam tug of remarkable power. The engines are two sets of triple expansion, the diameters of cylinders being 19 in., 33 in., and 54 in., respectively, with a stroke of 33 in. The vessel is 218 ft. by 31 ft. by 15½ ft.

Tempering Milling Cutters and Reamers.

BY A. B. LANDIS.

Tempering milling cutters and reamers may be, and no doubt is, simple and easily accomplished by those who are regularly in their manufacture, and have all the facilities and knowledge necessary. (I speak here more particularly with reference to mills and reamers having a wide face and large diameter, and rather deeply fluted.)

Those not having experience in tempering this kind of tool will often find, after having spent time and care in making them, that the process of tempering will mar them, if not make them entirely worthless. The effect of tempering tools of this kind in the ordinary way, by heating them to a proper heat and dipping into cold water, is that from the ends of the mill or reamer the teeth will crack and fly off for a considerable distance, and sometimes for a considerable time after the tempering has been done. The cause of this is that a severe strain has been brought upon the steel by the teeth being cooled first (owing to being thin), causing them to shrink in advance of the body of the tool, and while that portion is yet in a malleable state, a permanent set in the steel is produced, and when the shrinkage of the body occurs afterward this strain is produced, and causes the fracture as described. In the case of the reamer, it is likely to be altogether worthless, and with a miller (such as a spiral mill), it may probably still be used, but its value is much impaired, and it is an unsightly thing.

After considerable trouble in this direction, I tried different methods to overcome this difficulty, with partial success with some, and with others much better results. My greatest difficulty was with heavy, solid and shell reamers, and spiral mills of considerable length and diameter. One method was to bring to proper heat to take temper, and use warm water to dip them in. This would not cool them so rapidly, and yet would give sufficient temper to the teeth, and in nearly all cases obviate drawing the temper on them. This was, however, only a partial success, as in some cases there still appeared some of the same trouble, yet in many cases it proved quite satisfactory. This was the simplest remedy I found, although not as thorough as may be desired for all cases.

Another remedy I tried in the case of shell reamers and spiral mills, was to chamber out the inside of the mill, thus making the thickness of steel in the body of the mill very little greater than at the root of the tooth. This will cause the shrinkage to be more nearly simultaneous, and avoid the cracking referred to. But this, again, has its undesirable features, in that it requires more work in making the mill, and, consequently, more expense.

Another remedy was to use a bath of boiling hot lead to heat the tool in, which, by the intense heat, would rapidly heat to a red heat the points of the teeth only, then plunging into cold water we have a tool with hard teeth and soft body, without the severe strains from shrinkage that cause the fracture. This also leaves the root of the tooth soft, and consequently less liable to break in use. This method I consider a safe one, but unless persons are fixed with this kind of a tempering bath and furnace, it of course will have its objections. But if there is much of this class of tempering to do it will pay to have a bath of this kind, as it is valuable in tempering many other articles. The tool being excluded from the air in heating prevents oxidization, which is a very desirable feature.

Still another remedy I tried was (for tempering shell reamers and spiral mills) to heat the tool in the ordinary way to a uniform heat, slip it over a pipe having a hose connection at the other end, and the hose connected to a pipe with water pressure, having a stop-cock in same in convenient reach. In the end of pipe where tool is slipped over are a number of small holes drilled on all sides, and corresponding in length to that of the tool to be tempered.

To the end of this pipe a plate is quickly screwed, after the tool is placed over the pipe. This plate has small projections to raise it off the pipe ; it also closes the end of the pipe. We now hold the pipe vertically, center the tool around the pipe, and dip the tool in a tank of water, and at the same time that the tool is submerged turn open the stop-cock and hold the tool quietly in the water. The rapid stream of cold water from the holes in the pipe will more rapidly cool the inside of the tool than it will be cooled in the ordinary way, and thus make the shrinkage more nearly simultaneous, avoiding, in some degree, the trouble before cited. With this plan I have had very good success, and it is easily rigged up for.

To manufacturers of the tools here referred to, who make a regular business of it, these methods may be unnecessary, as they may have still better and simpler methods of overcoming the difficulty. But as I have no knowledge of how they do it, I have resorted to the different methods here described, as they suggested themselves to me. Some of them—perhaps all of them—may not be new, but no doubt to many they will be, and for the benefit of such, and for those whose vocation brings them in contact with this class of work, I contribute the above.

If any of the readers of the AMERICAN MACHINIST have better and more desirable methods of doing this work, I hope they will be generous and contribute the same to its columns.

I notice with interest, in your issue of Jan. 14th, what S. W. Goodyear says about steel, and I expected, when commencing to read the article, that he would give some of his ideas on steel. Instead, he gives nothing but "alleged facts from practical men." I know there are many of these, as some persons differ widely in their opinions, and certainly their diversified opinions cannot all be facts. I claim to know very little, if anything, about steel, and am led to believe (as a certain practical man once said to me, whose daily occupation was to superintend the working of steel in its various ways, "I don't know anything about steel,") that there is very much yet to be learned about it.

I hope Mr. Goodyear will continue to give us "Something About Steel," and give his views as to what is its proper treatment, as there is no doubt a great deal of "guesswork" in the many "alleged facts" he gives, as my experience with some of them has proven.

FIG. 1.

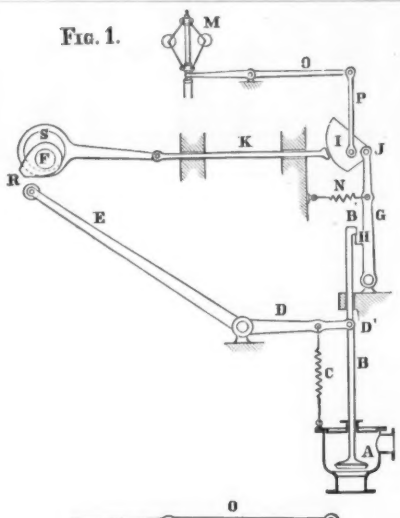
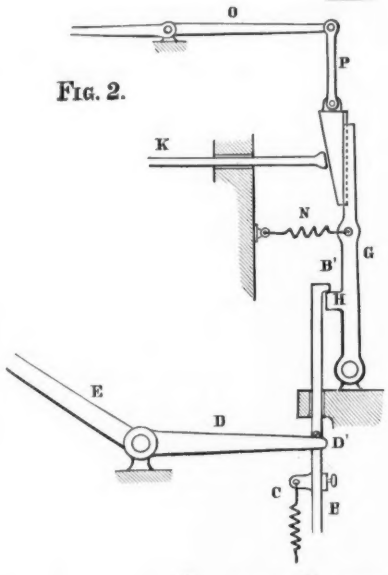


FIG. 2.



DETAILS OF KORTING GAS ENGINE.—SEE PAGE 1.

There was produced 6,417,148 gross tons of pig iron in the United States during the year 1887, an increase over the year 1886 of 733,819 tons.

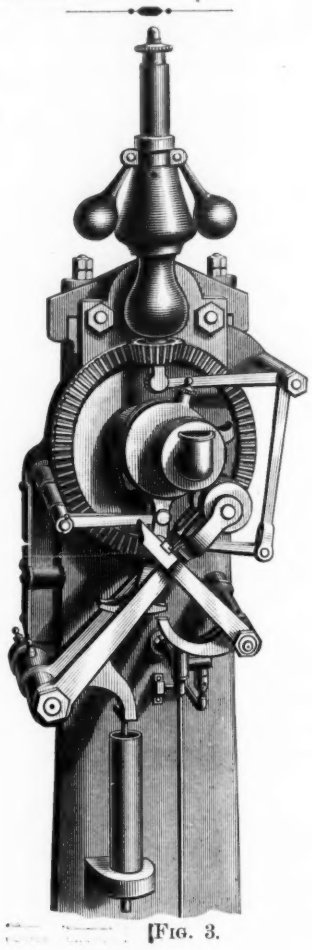


FIG. 3.

The crop of railroad accidents is phenomenally large this winter. It would be interesting to know just how many of these accidents were due to overworked engineers. This part of the subject is worthy of being investigaied much further than it has been as yet.

composition similar to melted sulphur. It must be cheap, and must adhere to a cast-iron plate and withstand heat, cold water and friction.

Modern Locomotive Construction.

BY J. G. A. MEYER.

FIFTY-EIGHTH PAPER.

Driving Wheels, continued.

Figs. 363 and 364 represent the two views of a driving wheel designed for a consolidation engine having cylinders 20 inches in diameter. Fig. 365 represents a section through the rim, and Figs. 366, 367 represent sections of one of the arms of these wheels. The arms are cast solid, the rim hollow, its form being similar to that of the rim shown in Fig. 358. The counterbalance weight is cast solid throughout, without any openings to prevent shrinkage stress.

Figs. 368 and 369 represent two views of another driving wheel designed for a consolidation engine with cylinders 20 inches in diameter. The construction of this wheel is somewhat different from that shown in Fig. 363, as the wheel shown in Fig. 369 has hollow spokes, the hollow part of the rim extending to the periphery of the wheel and strengthened by the ribs *r*, *r*; the counterbalance has—for the purpose of avoiding shrinkage stress—openings cast into it, and extending to the rim.

In Fig. 368 we see that the inner face of the wheel center projects beyond the inner face of the tire.

This style of wheel is adopted for locomotives designed for roads having a track of 5 feet gauge, which in the near future are to be reduced to a gauge of 4 feet 8½ inches. Now, locomotives designed for a 5 feet gauge, and having the tires placed on the wheel centers, as shown in Fig. 369, can readily be changed to suit a gauge of 4 feet 8½ inches, as all that need to be done to accomplish this purpose is to heat the tires and move them inwards on the wheel centers, and then turn off the outer face of the wheel centers to suit the tires.

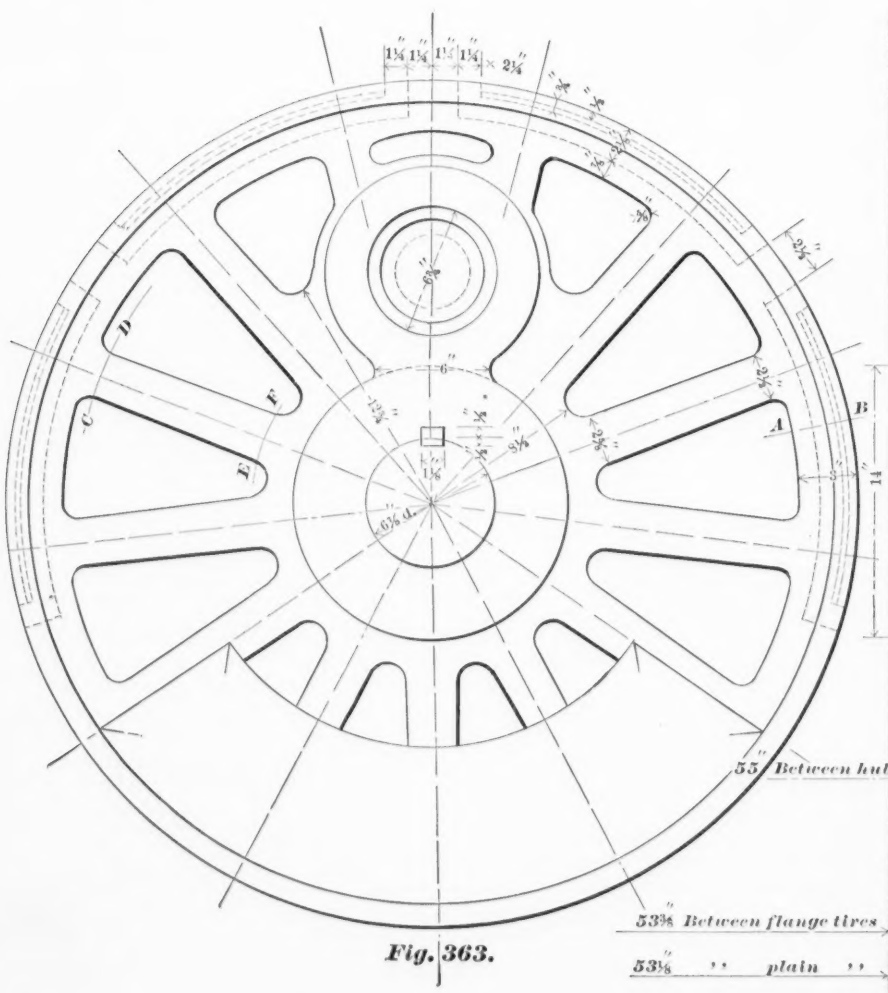


Fig. 363.

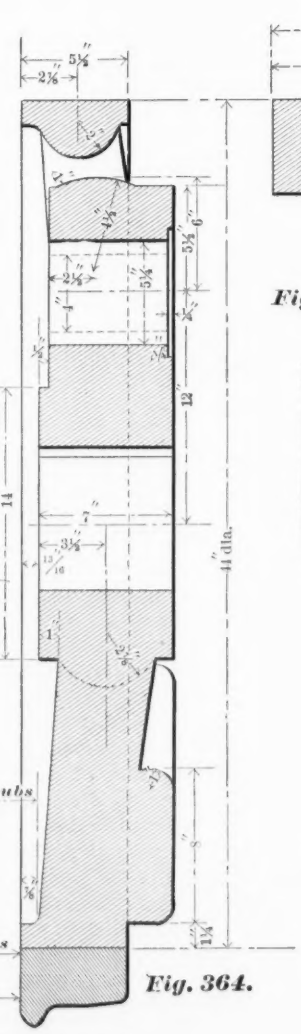


Fig. 364.

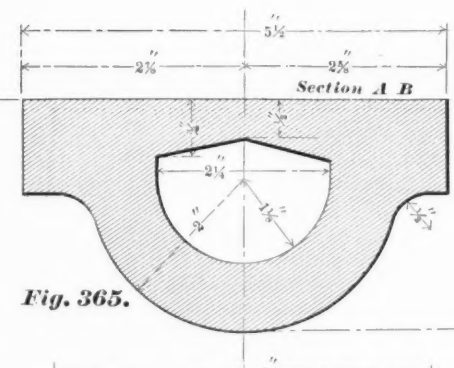


Fig. 365.

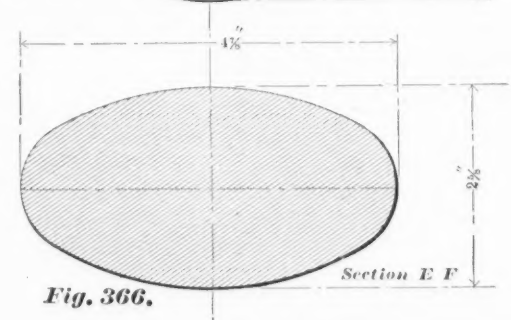


Fig. 366.

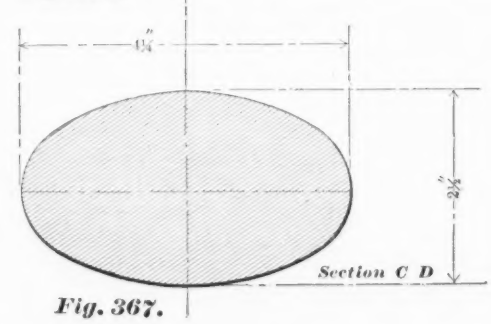


Fig. 367.

MODERN LOCOMOTIVE CONSTRUCTION.

Forty-seven persons were killed or injured at railroad crossings in Massachusetts during the year 1887, nearly half of the accidents occurring at protected crossings.

The German government has official account of 170,000 incandescent lamps in use in the empire.

A correspondent would like to know of a

Counterbalance.

In traveling in a railroad car it may sometimes be noticed that the motion of the train is not uniform, but is accompanied

by jerks occurring at regular intervals. This kind of irregular motion is often due to the locomotive, which is imperfectly counterbalanced. Consequently, we may say—in a general way—that in a locomotive, all parts whose weights have a bad influence on the smooth forward and backward motion of the engine, and tend to produce jerks in its motion, must be counterbalanced; and therefore, not only the weight of the crank and its pin, and other parts attached to the crank pin, which have a rotary motion, must be counterbalanced, but also those parts which are attached to the crank pin and have a reciprocating motion. Hence, in locomotives, the weights of the cranks, pins, connecting and side rods, piston rods, crossheads and pistons must be counterbalanced.*

In order to explain as clearly as possible the method of counterbalancing these parts of the engine, and reduce this subject to simple problems, we will first consider the principles upon which the method is based, and the application of these principles to the method used for finding the counterbalance for objects of simple outline.

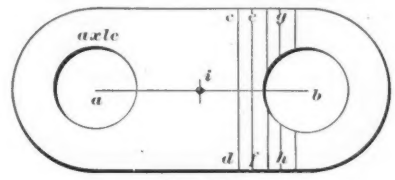


Fig. 370.

Fig. 371.

e f, etc., into any number of parts, then the weight of each part with a leverage corresponding to the distance between it and the center *a* of the axle will act with a certain amount of energy, and tend to turn the axle around its center, and thus bring the center line *a b* of the crank in a vertical position below the axle.

Now, in order to enable us to compare readily the amount of this energy with a force applied to some other point at a given distance from the center *a*, we assume that the whole weight of the crank is concentrated at one point—the center of gravity—or applied to a point coinciding with the center of gravity, we obtain an easy way of comparing the energy developed by the weight of the crank, and that developed by the counterbalance, and also an easy way for determining the number of pounds of metal required in the counterbalance.

In determining the counterbalance we must also find its center of gravity, and, as in the case of the crank, assume it to be applied to a point coinciding with the center of gravity.

These conditions will reduce the whole method of counterbalancing to a simple problem, in which the given conditions are such as represented in Fig. 371. In this figure the point *a* represents the center of the axle; the line *k b*, passing through the center *a*, represents a lever whose fulcrum is at *a*; the line *a b* is one of its lever arms, whose length is equal to the distance between the center of the axle and the center of gravity of the crank. The line *a k* is the other lever arm, whose length is equal to the distance between the center of the axle and the center of gravity of the counterbalance. The weight of the crank is represented by *C* and attached to the point *b*; the weight of the counterbalance is represented by *R*, and is attached to the point *k*.

Now, since in all levers of this kind, and which are in equilibrium, the product obtained by multiplying the length of the lever arm *a b* by the weight *C*, which is suspended from this arm, must be equal to the product obtained by multiplying the length of the lever arm *a k* by the weight *R* suspended from this arm, we can find the number of pounds of metal required in the counterbalance by the following rule:

Rule 39. Multiply the distance between the center of the axle and the center of gravity of the crank in inches, by the weight of the crank in pounds, and divide this product by the distance between the center of the axle and the center of gravity of the counterbalance in inches; the quotient will be the weight of the counterbalance in pounds.

Ex. 71. The length of the crank (Fig. 370), from the center *a* to the center *b*, is 12 inches; the weight of the crank 300 pounds. It is required to find the weight of the counterbalance, which is placed so that the distance between its center of gravity and the center of the axle is 9 inches.

Since the form of this crank is symmetrical, and since its length is 12 inches, the distance between its center of gravity and the center of axle is 6 inches; hence we have $\frac{6 \times 300}{9} = 200$ pounds;

which is the weight necessary for counterbalancing the weight of the crank only.

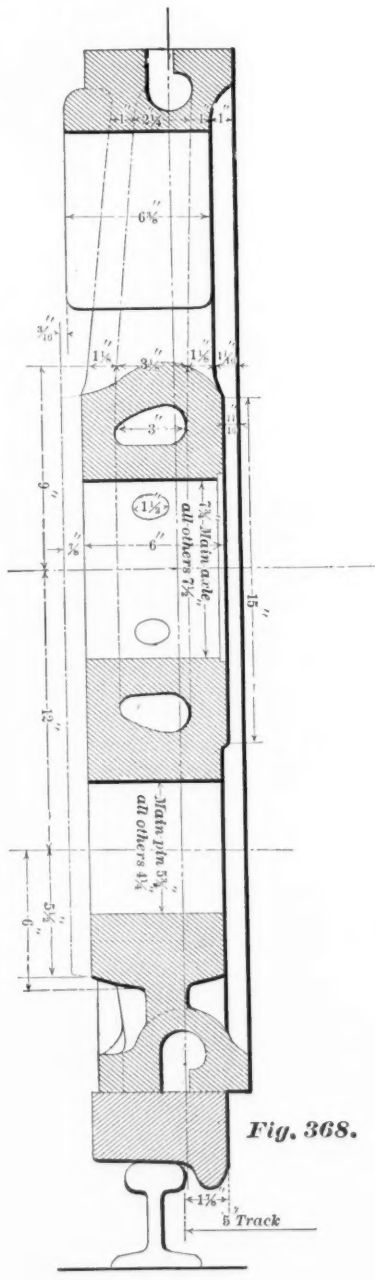


Fig. 368.

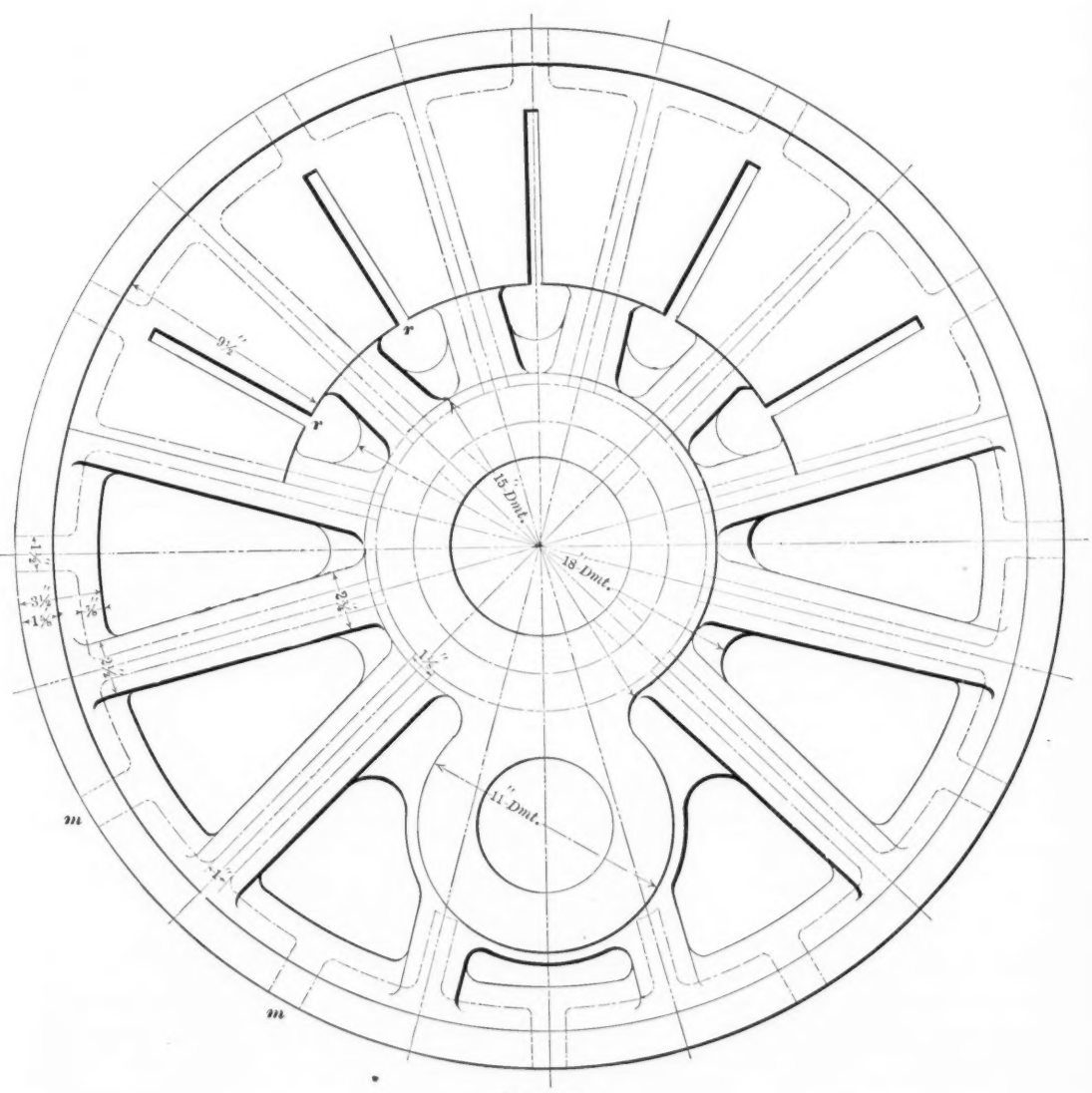


Fig. 369

45 *Inch Wheel Center.*

MODERN LOCOMOTIVE CONSTRUCTION.—SEE PAGE 2.

In the first place, then, we will determine the amount of counterbalance required for a crank, such as is shown in Fig. 370. This crank is supposed to be of equal thickness throughout, and its form is perfectly symmetrical; that is to say, the diameter of the hole for the axle is equal to that of the hole for the crank pin, the ends of the crank are exactly alike, and the depth *c d*, or *e f*, the same throughout.

Assume now, that the crank stands in a horizontal position, as shown in our illustration, and that the crank is divided by vertical planes represented by the lines *c d*,

* A difference of opinion exists in regard to the amount of weight to be counterbalanced, as will be seen in a future paper.

Oil Extractor.

One of the most serious objections in the minds of engineers to open heaters is that they allow the oil that is used in the cylinder of the engine to pass into the boiler. To avoid this, Frank M. Clarkson, Detroit, Mich., applies the device represented in the accompanying engravings to the Rice Feed-Water Heater and Purifier which he sells.

The efficiency of this device for extracting the oil from the exhaust steam depends upon the fact that the oil is forced along the inside surface of the exhaust pipe and in contact with that surface. Therefore in Fig. 1, which represents the principle of the device when only part of the exhaust steam goes through the heater, when the oil, flowing along the inside surface reaches the threaded end of the branch pipe projecting into the main exhaust pipe, it cannot flow over the end and on into the heater, but flows around the threads and on into the open air.

Fig. 2 represents the form of the device when all of the exhaust steam is led to the heater. The oil will flow over the end of the pipe by which it enters the globe and settle in the bottom, whence it can be drained off by the small oil drip.

While the device illustrated was particularly designed for use with the heater mentioned, and to overcome objections referred to, it can be used with equally good results whenever it is desirable to separate oil from exhaust steam.

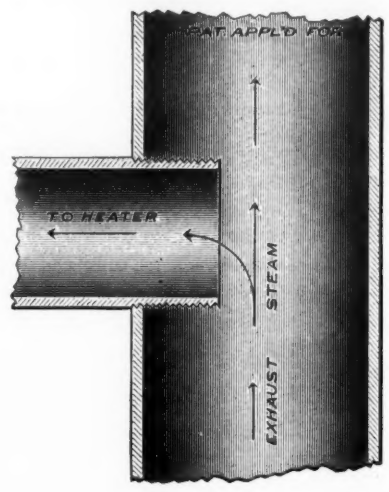


FIG. 1. OIL EXTRACTOR.

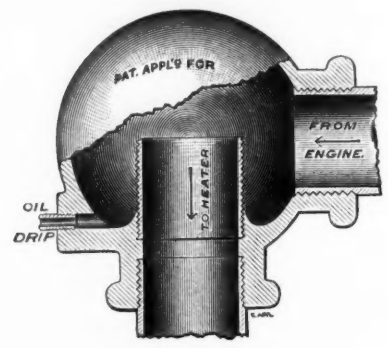


FIG. 2.

Are Monopolies and Combinations Altogether Bad?

BY J. G. TRAMIS.

If it would be a good thing to have the Government own the telegraphs, why not also the savings banks? Our postal system is in nearly every feature, if not in every detail, copied from the English, and each new feature added has been after England has had several years' experience with it. They have had several years more experience with the postal savings banks than they have had with postal telegraphs, and while with possibly not the greatest success, it hardly follows that it would not prove a success here, because no local savings bank in England can compare with ours under like conditions. The proportion of the English people who have the chance and disposition to save is greatly less than of our own. Postal savings banks, under Government control, would be safe, and a savings bank at every post-office would be a great convenience, if not a national blessing.

The objection raised is that it will add another hoard of office-seekers to the already uncontrollable crowd, but certainly less than the telegraph would.

Without disputing the question that great monopolies are great evils, and that the new-fangled trusts are to be looked upon with suspicion, is it necessary to conclude that because a combination is formed prices of their product are to be raised, or are greater than they would be if the trust or combination did not exist? It is true that the parties in the combination make more money than when in direct competition, but that is no evidence that the price of the product sold to the consumer is any higher, but simply that competition costs money, which is saved in combination. There are no doubt many concerns in the country, struggling along between a bare living and a failure, when if the cost of selling their products could be saved, they would grow rich, and the consumer get the goods at the same price, and the same amount of goods be sold.

Aside from Government management of the telegraphs, in what way could the public be so well and as cheaply supplied with telegraph service as now, objectionable as the Western Union monopoly is? If each State had its own company, the Interstate Telegraph Commission would do just as has been done with freights, in which the short-haul rates have been kept where they were, and the long-haul raised up to correspond, and put some millions into the R. R. Co.'s assets. State telegraphs would mean State line transfers, which the sender would have to pay for, besides for double or triple transmission.

Two rival telegraph companies in place of one, or three in place of two, means extra cost of plant and extra cost of service, all of which the public would have to pay for. It appears to me that if we had no freight lines like the "Blue Line," or "Merchants' Dispatch," that extend over large areas of territory, and no telegraph extending over the entire country, like the Western Union, we would meet with many inconveniences that do not now trouble us, and any institution that covers the whole country must be extensive, must be rich, must be very near a monopoly.

I was once interested in an industry connected with agricultural interests, and indirectly instrumental in forming a combine, the result of which is that a single corporation supply the entire machine builders of the country with that one article, except such as the machine builders make to a limited extent themselves, and yet the price is constantly lowered, as the material and improved processes lower them. Yes, this company makes money, and lots of it, but the goods are delivered of the best possible quality, and at prices below what they could be with the amount produced divided in half—with cost of selling—or the quality would have to be sacrificed to meet the competition. To report a case that actually occurred to the company referred to, a customer said: "We hardly think we will give you our work any more; we think we can do it cheaper ourselves." "Well, what can you do it for?" "Five dollars a hundred." "What profit are you willing we should make on our work?" "Five per cent." "You are not willing to work on a margin of five per cent., are you?" "No; not hardly; but we will give you that, and unless you will do it for that we will do it ourselves."

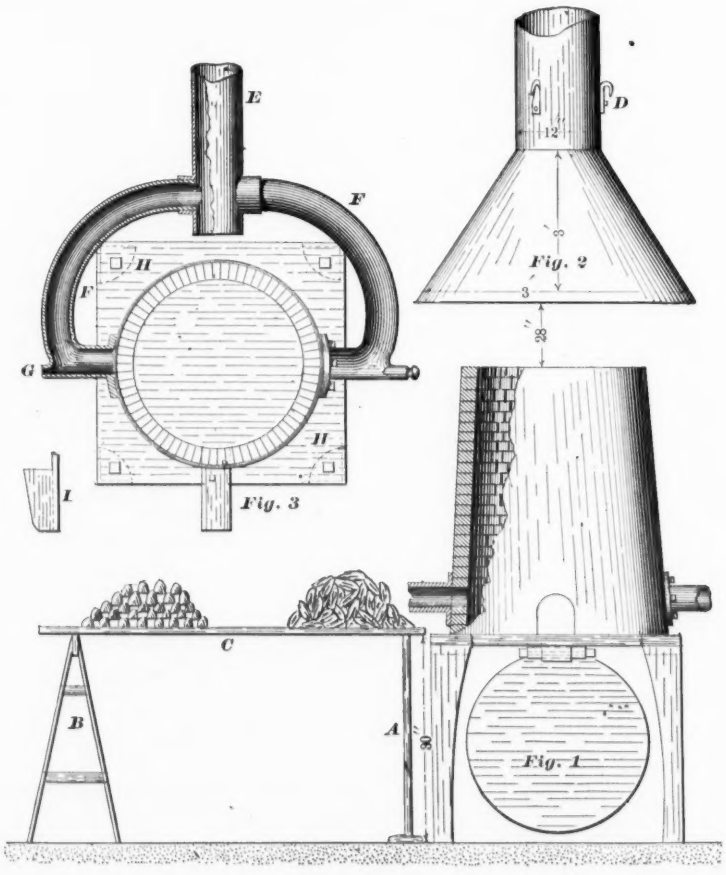
The company took the contract, and furnished a much better article than the machine builders could make, because they have had years of experience, buy in quantity, use improved methods and machinery, and have a thorough knowledge of the business. They can make more than five per cent.

Mind, I don't say a monopoly is not a bad thing, but simply claim that it is not necessarily so, and because a trust makes money it does not follow that the public are swindled.

Foundry Cupolas.

BY ROBERT E. MASTERS.

I present a small cupola that we have kept in constant use for the past two years, notwithstanding we have one double and two single air furnaces and five other cupolas ranging in size from 30″ to 72″ diameter, from one or the other of which we can obtain fluid metal almost any time.



A SMALL CUPOLA.

I merely mention the above fact to show the advantage and usefulness of a furnace of this kind. The purpose of operating it is the production of castings of special mixtures, such as cams, heading dies and small forms for spike and horseshoe mills, experimental mixtures, testing the various brands of iron, and we have used it for melting up quantities of light and heavy old scrap brass, so it can be handled to advantage in the crucibles.

Fig. 1 represents the cupola broken away so that it will be readily understood; the shape of it allows the material to settle freely, and I think in a manner concentrates the heat. *A* is cast-iron and *B* wooden trestles to support the slab *C*, which answers for a charging floor. Fig. 2 is a sheet-iron hood and stack held by three guy rods from hooks *D*. Fig. 3 shows the arrangements of the blast pipes; a 75″ Sturtevant blower, with a 16″ main pipe extending around the wall, with branch pipes to twenty forges, is used in the blacksmith shop to supply them with blast. The pipe *E* goes through the wall and connects with one of these branch pipes. *E* and *F* are of cast-iron, with a peep hole at *G*. The dotted lines *H H* are the tops of the angle-shaped legs bolted to the plate; the cupola shell is riveted to the plate with three small wrought angle irons; *I* is the side view of the spout.

There is often so much power required from the wheel that runs the blacksmith shop fan that, while the blast is all that is needed for the forges, it is hardly enough for the cupola.

DIMENSIONS OF CUPOLA.

Outside diameter at bottom, 26½″; at top, 24½″. Thickness of lining, 3″. Height from bottom plate to top of shell, 4′. Style of tuyeres, plain round. Size of tuyeres, 2¾″. Number of tuyeres, 2. Height from bottom plate to bottom of tuyeres, 9″. Height of tuyeres above sand bottom, 6″. Size and length of pipe *E*, 6″ diameter; 8 feet long. Size and length of pipe *F*, 2¾″ diameter; 30″ long. Cupola 200 feet from fan.

MODE OF CHARGING CUPOLA.

Fuel used for bed	Coal,	100 lbs.
First charge of iron....pig, 250 lbs.;	Scrap,	150 "
First charge of fuel	Coal,	50 "
Second charge of iron..pig, 180 lbs.:	Scrap,	120 "
Second charge of fuel	Coal,	45 "
Third charge of iron...pig, 180 lbs.:	Scrap,	120 "
Third charge of fuel	Coal,	40 "
Fourth charge of iron..pig, 120 lbs.;	Scrap,	80 "

MODE OF WORKING CUPOLA.

Time of starting fire	2:00 P. M.
Time of charging first iron	2:40 "
Blast put on	3:30 "
First appearance fluid iron	3:37 "
First stopped in	3:40 "
Bottom dropped	5:35 "

Kind of fuel used, best Lehigh coal.

TOTALS.

Amount of iron melted	1,200 pounds.
Amount of fuel consumed	235 "
Ratio of fuel to iron used	1 to 5 1-10
Fluidity of melted iron	Hot.

I said in the commencement of this article we had melted quantities of scrap brass in this furnace, and run it into ingots, but excuse me from melting any more large quantities of old brass in a cupola or air furnace unless there is some arrangement to carry off the fumes of the zinc, or we do the work in the open air. This cupola is situated in a small brass foundry, 30x45 feet, and the five men (myself included) who were in the foundry, had, I think, a clear case of zinc poisoning from breathing in the oxide of zinc vapor with which the shop was filled, coming from the zinc in the old brass. We were all afflicted alike; nauseating sickness, chill and high fever, followed by a difficulty in taking a long breath. As I have not seen a heat of this kind reported I append the results.

MODE OF CHARGING CUPOLA.

Fuel for bed	Coke,	100 lbs.
First charge of brass		600 "
First charge of fuel	Coke,	65 "
Second charge of brass		500 "
Second charge of fuel	Coke,	60 "
Third charge of brass		500 "
Third charge of fuel	Coke,	60 "
Fourth charge of brass		510 "

MODE OF WORKING CUPOLA.

Time starting fire	11:00 A. M.
Time charging first brass	11:40 "
Blast put on	12:00 M.
First appearance of fluid brass	12:03 P. M.
First tap	12:13 "
Bottom dropped	3:40 "

TOTALS.

Amount of brass melted	2,110 lbs.
Amount of fuel consumed	285 "
Ratio of fuel to brass	1 to 7 4-10
Brass	Hot.

We have melted bronze pinions of 400 pounds' weight in this cupola, and can make bronze castings from it of 600 pounds' weight. The figures in a bronze heat are about the same as the above, and we have made bronze castings as high as 5,000 pounds in a single casting from the air furnace, and we have never suffered any inconvenience when making new mixtures without zinc.

It is said that every theater in Madrid is to be prohibited from opening its doors unless it is lighted by electricity.

Wilson's Speed Controller.

The operation of this device will be understood by everyone acquainted with the action of a governor.

The controller is attached to the governor so that the ball on the lever is held in equilibrium so long as the engine is running at its regular rate of speed. Should the speed of the engine slacken, the ball is immediately moved off its equilibrium to the right, and additional weight is added to the governor, forcing the balls down, allowing more steam to enter the cylinder, thereby bringing the engine up to its regular speed. Should the speed of engine increase, the operation is reversed, and the ball is moved off its equilibrium to the left, forcing the governor balls up, and by partially closing the valve, reducing the speed of the engine to its regular rate. This action is so quick of operation that it is guaranteed to keep the engine within less than one revolution of its regular speed, under varying loads. In making the attachment, it is necessary to see that the engine is making its regular speed, then place the lever in a vertical position, with segment at right angles to it; then throw off the load and place the ball on the lever, at such a point that the speed will be half a revolution above the load.

The manufacturers are the Remington Machine Company, Wilmington, Del.

Shop Notes.

BY JARNO.

COPPERING BRASS.

The well-known machinist's coppering solution can be composed of one ounce of sulphate of copper, or blue vitriol, dissolved in about four ounces of water. The addition of a teaspoonful of nitric acid will make the solution work quicker.

This solution has but little or no effect when simply placed upon brass.

Let us clean the brass. Put some of the solution upon the place to be coppered. Now, in the solution hold any small piece of steel or iron, letting it touch the brass. We soon see a very interesting thing. A film of copper soon covers the brass wherever there is any of the solution. The solution can also be applied drop by drop with a piece of iron or steel wire.

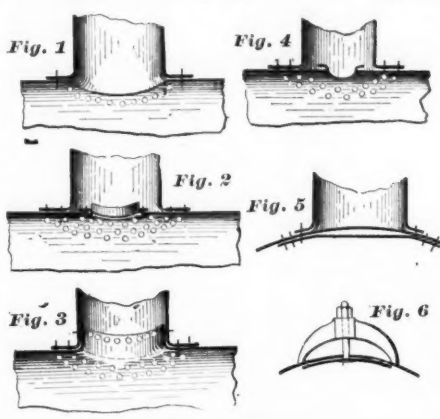
English Boiler Inspection.

BY W. H. BOOTH.

SIXTH PAPER.

One of the most frequent defects found in steam boilers is the weakening of the shell by the cutting away of large areas of the plates at the crown for the various mountings, such as manhole, dome, etc. The writer has found large boilers in the crown of which have been cut large holes in adjacent rings of plate, one for the dome and one for the cast-iron manhole mouthpiece, and it is quite common to find the openings for domes to be cut away to the full size of the diameter of the dome, perhaps 2 ft. 10 in. or 3 ft. diameter, and even domes of 4 ft. diameter have been found whose opening to the boiler has been equally large. Such a practice is, of course, most reprehensible. The bursting stress upon the shell, which should properly be borne by the cut-away plate, is concentrated upon the material at the edge of the large hole, excepting such portion as is taken up by the dome. Signs of the straining produced may often be seen in leakage at the crown of the boiler at the dome rivets—*i. e.*, just front and back of the dome.

This leakage is due, of course, to the lifting tendency of the steam pressure upon the dome crown, and, combined with the concentrated stress upon the edge of the hole, exerts great influence in producing possible rupture of the plate, with an explosion. The faultly method of dome attachment is shown in Fig. 1, whilst in Fig. 2 is shown the method advised for safety, a hole being cut in the boiler crown of only 14 or 16 inches diameter, and for all high pressures the best practice would add a strengthening piece, as also shown in Fig. 2, round the edge of the plate where cut away. Usually, too, the dome would not be attached as shown by a flanged base, but by a stout angle iron ring. The American method of flanging up the plate round the edge of the hole, as well as the dome itself, as in Fig. 3, has been little followed in English practice, but might be with advantage, and when the method of Fig. 2 is adopted, it is probable that a flanging back of the plate edge to give a double thickness, as in Fig. 4, would be stronger than the angle iron shown. A method possessing a good deal of apparent strength is to attach the dome without cutting away the plate at all as a whole. The plate is merely drilled with half or five-eighth inch holes all over the dome opening, so as to admit steam to the pipes, and the drilled plate serves as a separator of entrained water. The disadvantage of this method is that it precludes all internal inspection of the dome. The idea that this method does not weaken the boiler is founded on a misconception which is apparent when it is remembered that the perforated plate, having steam pressure upon both sides, is exposed simply to a direct tensile stress from the bursting pressure of the steam, and tends to flatten out and form a straight bar from side to side of the dome. In an old boiler, where it is desired to strengthen the weak dome opening, a strong flat bar may be riveted across the dome, as in Fig. 5. This bar being straight, withstands the opening tendency of the shell of the boiler by direct tension, and is the best method of staying a weakened shell in old boilers. Manhole openings are often even more dangerous than domes. Many are found wholly unstrengthened, and very frequently the cover is internal and is drawn to a tight joint with the plate by a pair of screws passing through bridge bars, bestriding the opening, as in Fig. 6.



ENGLISH BOILER INSPECTION.

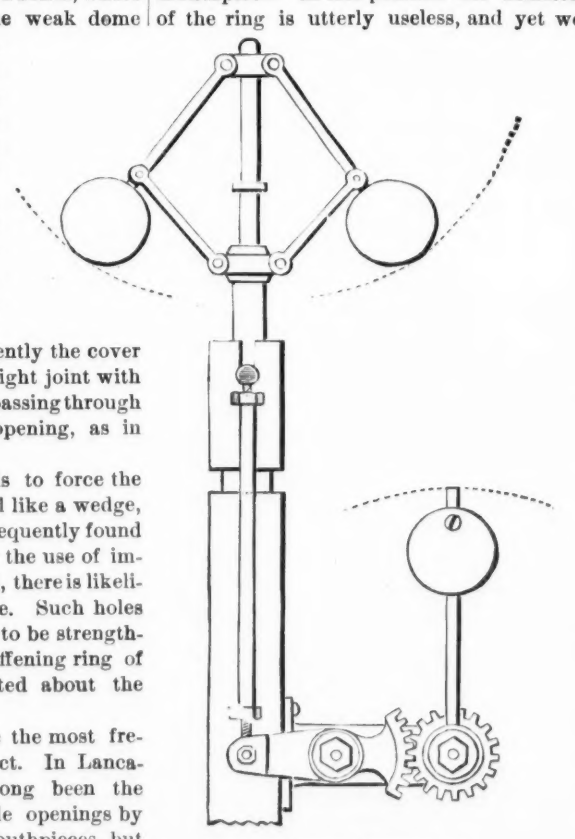
The tendency of course is to force the cover through the boiler shell like a wedge, and, as the plate edges are frequently found to be seriously crowded by the use of improper joint-making material, there is likelihood of disaster taking place. Such holes are invariably recommended to be strengthened by the addition of a stiffening ring of 4″x½″, or thereabouts, riveted about the hole.

Small circular boilers are the most frequent offenders in this respect. In Lancashire boilers it has now long been the custom to stiffen all manhole openings by means of strong cast-iron mouthpieces, but for pressures above 70 pounds cast-iron is not to be recommended, owing to its low limit of elasticity and small tensile strength.

Properly speaking, the thickness of a cast-iron mouthpiece flange should be about double the thickness of the plate it is connected with. Usually, however, the thickness is fourfold, and the result is that under stress the cast-iron is too stiff, and bears too great a share of the load and may tear sooner than it would do if thinner. The material anyhow is unsatisfactory, and in the best practice of to-day mouthpieces are made of wrought-iron or steel welded up or of cast-steel, or, better still, of steel plate pressed by hydraulic power from solid disks of plate, as is done by the Leeds Forge Company, who thus utilize the plate cut away to form the furnace openings of marine boiler end plates or heads. In making these mountings the plate is thus drawn in the pressing, to the required thickness for the lower flange, and the upper flange for taking the cover, remains of the proper thickness—about one inch.

In all new work for modern pressures the manhole opening is not merely strengthened by a good double-riveted mouthpiece, but also by an internal strip ring, this latter being treble-riveted. Frequently, however, notably in the practice of Mr. Adamson, this strip ring is omitted, its place being filled by a piece of plate extending around the crown of the boiler to some distance each side of the mouthpiece. Being well riveted to the shell, the manhole ring of the plate is rendered fully as strong as any other portion of the boiler, but the fact that modern practice deems such an arrangement none too strong is evidence that old constructions must have been exceedingly weak. In the smaller mounting blocks, too, for steam pipes and safety valves, it is now considered best to use wrought-iron or steel exclusively, and, though the mudhole in the lower part of the front end or head is still frequently of cast-iron, the practice ought to be condemned as unsafe, though the boiler insurance companies have exhibited remarkable laxity in this respect, especially when their stringency in regard to the smaller shell mountings is considered. Frequently on inspection it is advised that manholes be strengthened by the addition internally of the strip ring.

Now, in an old boiler such a ring cannot be put on in one piece, but must be made in halves. As its duty is to strengthen the boiler against bursting, the butting ends of the rings should be in a line encircling the boiler, and not in the longitudinal direction, which would bring the joints right on the crown of the boiler front and back of the mouthpiece. In this position the addition of the ring is utterly useless, and yet we have found boiler repairs to be thus effected by ignorant men. It is important, then, to see that when strip rings are applied in halves to joints run round the boiler or otherwise, no strength is gained. For gauge pressures above 70 pounds, cast-iron is now considered altogether unsuitable for manhole mouth-pieces, and beyond 90 or 100 pounds the smaller mountings should also be of wrought-iron or steel. Drums are now rarely applied to new boilers, the use of an anti-priming pipe being found sufficient to insure a supply of dry steam.



SPEED CONTROLLER.

Very frequently domes are found thickly lined with mud—a proof of priming. To prevent this a baffle plate should be hung below the dome, so that no steam can rise directly from the water, but all steam entering the dome travels along the boiler crown, and as the crown is supplied all along its length, no sudden rush of steam can take place, and so priming is avoided. Some waters when carried over as priming cause severe cutting of valves and pistons from the particles of hard material carried over with the water, and heavy repairs have been required from this apparent simple cause. The spindles of mushroom valves may frequently be found seriously cut away from the same cause—gritty particles which have a sand-blast action.

A Fireman Who Thinks.

The *Troy* (N. Y.) *Observer* thus notices a Troy fireman who has been a frequent contributor to the columns of the AMERICAN MACHINIST. Mr. Bradt, as we happen to know, is a first class machinist, and one of the kind that thinks as well as works. He attained an enviable notoriety as a mechanic long before he was connected with fire matters:

There are many ingenious engineers in the department, but the greatest one of them all is "Billy" Bradt. A short time ago he got up a lamp lighter, which can be used successfully when the wind is blowing. It consists of a little clamp in which is placed a common match, to which is attached a long stem. By pulling the match through this it is ignited. But his latest wrinkle is a scheme by which a driver can hang a pair of gloves at the side of his seat. They are held in position by the aid of a little pair of hangers, in which is cut a slot, and neatly fastened to the rail about the seat by a set screw. The button is placed in the slot and the glove hangs open, and thus enables the driver to place his hands in them without any trouble.

Although no official report on the performance of the rotary steam snow shovels, ten of which were built at the Cooke Locomotive and Machine Works, has been received by the builders, yet private letters received by them seem to indicate that they work very successfully; in fact, these snow shovels seem to do more than was claimed for them. The present severe weather in the Western States affords a good opportunity to subject these snow shovels to a severe test, and no doubt, the reports on their performances, when received, will be interesting and instructive.

LETTERS FROM PRACTICAL MEN.

Lining Smoke Stacks.

Editor American Machinist:

In your issue of Feb. 4th, I notice your answer to question No. 54, by J. S., of New York.

While your plan of a double stack will work much better than a single one without a lining, I can assure you that a lining of fire-brick, from 2½″ to 4½″ thick, will give better results, as to economy, efficiency and durability, than any other plan the writer has ever heard of. I once reduced a 48″ wrought-iron stack to 38½″ diameter, by lining it with the common commercial fire-brick, 4½″ wide, 9″ long and 2½″ thick, and, although the area of the stack was reduced over one-third, the draft was very much improved, as the stack and its lining were always warm, and quite hot for a distance of 30 feet from the base. The stack was 70 feet high, and would take up sufficient air to burn 17 pounds of coal on a square foot of grate per hour.

If, in designing a wrought-iron smoke stack, proper attention is given to the details, it can be made almost as durable as a brick chimney. First of all, arrange to line every stack with a 4½″ thickness of good fire-brick; and if it is over 5 feet in diameter the lining should be 9″ thick for about one-third of its whole height, and 4½″ thick the remaining distance.

If the grate surface requires a 36″ flue, then the lining must be 36″ diameter inside, while the stack will be 45″ inside, or, more correctly speaking, 45½″, as there should be

a layer of fire-clay between the brick lining and the metal sheet. Red brick can be used, but are not durable. The stack should be lined to the extreme top.

Then there should be a worm hoist, with a ring scaffold made in halves and encircling the stack, to be used in painting the outside of the shell, with any of the well known mixtures for preserving the iron. The stack should rest on a housing of two plates and four columns, all resting on a concrete foundation.

J. S. can put a lining 2″ thick in his 18′ stack, in ring sections.

W. H. HOFFMAN.

94 Liberty street, New York.

"Ice in a Steam Pipe."

Editor American Machinist:

If Mr. Torrey's steam pipe is frozen solid, and he tries to thaw it by turning on steam, he will be very likely to burst it, if it is not already bursted. The steam will not thaw it; that is, not in any reasonable time. If he will punch a hole in the pipe a short distance from where the steam is connected, it will thaw the pipe and also save bursting it.

A. J.

Editor American Machinist:

Noticing in your issue of Feb. 4th several communications on the above subject, I venture to add another.

A neighbor of mine got a pipe frozen up in the last cold snap, and adopted the following very effective method: He wrapped rags around his pipe, poured on kerosene oil, and touched it off—thereby setting on fire his house and barn, which were entirely consumed, and thawing his pipe so that it will not trouble him for the remainder of the season.

WILLIAM H. HARRISON.

Braintree, Mass.

Editor American Machinist:

In your issue of February 4, I notice five replies to Mr. Torrey's "Ice in a Steam Pipe," and the best consolation that they give him is to find the lowest place, start a fire under it and wait patiently till it thaws Now I don't claim to be an expert on frozen pipes, but I've been there on several occasions; my advice to Mr. Torrey would be to take some old cloth, discarded clothes, waste, old carpet or anything of that kind, and lay on the pipe to be thawed, then get some good hot water and pour it on. The cloth will hold the heat on the pipe and thaw it out in five minutes. This holds good in the case of any kind of a freeze that I know off, water wheel or anything else.

SAW MILL.

A Draftsman's Experience—Standard Dimensions for Lathes—Cheaper Gears Wanted.

Editor American Machinist:

In digesting the AMERICAN MACHINIST this week (February 4th) I find it, as usual, full of good food, especially the editorial page. The article on drawing-room hours reminded me very forcibly of an "ancient" employer of mine, who worked the draftsman fifteen hours a day, same as the shop hands, and kindly gave me a drawing-board to take home for use "evenings" (after ten o'clock), because I unfortunately remarked, one day, that I "could work faster and clearer at midnight than at any other hour." And that again reminds me that some time ago, while busy manipulating the leather in my head over a drawing, one of the "cubs" came in to get a $\frac{7}{64}$″ twist drill. After attending to his wants, I went on with my work figuring dimensions. Yesterday one of the hands brought in a drawing for explanation. One dimension was Greek to him. It had

Outside diam. one $\frac{7}{64}$″ twist drill

I understood.

Don't you think it would be a great thing if all lathe builders in the country would meet in convention, and adopt a standard thread for lead screws; a standard diameter and thread for the spindles, and a standard method of gears for screw cutting for each swing of lathe built? Of course this would not prevent some of our enterprising builders calling attention to "our new 24″ lathe, which swings 29 inches."

If such a thing as a standard like this could be established, the buyers of tools would be able to feel the "eternal fitness" of shop tools, so to speak.

I notice my friend Holz speaks of some remarkable work by a cutter in cutting gear teeth. If that cutter with twelve teeth cut 30,000 gear teeth, and was good for many more, and was cheap to make, then I am kicking for a big reduction in the price of cut gears.

GRUMBLER.

Steam Pumps.

Editor American Machinist:

In your issue of Jan. 28th, I read an article on covering for steam cylinders, by T. T. Parker, which excites my interest. May I express an idea which may be old and well known, and may be in practice, but I have never seen or heard tell of it?

Why are all pump steam chests placed on top of cylinder, always leaving the clearance space full of condense awaiting the admission of live steam so as to condense it and require fully (it seems to me) one-third more than it would if the chest were placed on the side, or better yet, at the bottom, or under the cylinder, so that when the steam is exhausted it will drain the cylinder of all the condense that may have accumulated during the stroke of the piston, which, on a pump of high duty but running very slow, amounts to considerable. The pump that I use to supply the boilers is a No. 3 Deane, making about twenty strokes per minute, and after running about fifteen minutes, if I open the cylinder cocks, there will be a great amount of condense blown out. This I am satisfied was all in the cylinder, as my exhaust pipe slants downward from the chest, therefore, it could not be standing in some bend or elbow of that pipe; it must, it seems to me, fill the entire clearance, or how can it be exhausted? Of course, when the piston finishes the stroke and the exhaust takes place, the sudden release of the steam will carry much of it off, but there is enough of the condense retained to greatly aid in condensing the live steam when it is admitted.

It seems to me that if the chest were placed under the cylinder and valves used that would work with chest in that position, and chest made to open on side for access to valves, that the pump would look neater, be easier lagged (which, to my idea, or to the benefit of the coal pile, is very essential, as Mr. Parker says,) work better, steadier, and use much less steam.

O. P. SELLS.

Soda and Crude Petroleum for Preventing and Removing Boiler Scale.

In a paper read before the Western Railway Club, Geo. M. Gibbs, of the C. M. and St. Paul Railway, gave some account of the manner of preventing scale in their boilers. The water in the country through which the road runs is bad, and to enable them to use it satisfactorily they use a boiler compound, which, he said, was a mixture of about one pound of caustic soda and a half pound of carbonate of soda to the gallon. The cost of a gallon of the compound was about four cents, and the average cost for a thousand mile run would probably be about 40 cents. Mr. Gibbs said, referring to the use of this compound:

On the C. M. and St. Paul we use a "boiler compound" in all cases; this makes us reasonably independent of the amount of incrusting matter present. We can deal with great success with waters having 35 to 40 grains incrusting matter per gallon, provided no alkali be present. I make the reservation because our compound is itself an alkali; so, in adding it to a water we must have a care not to bring the total alkali above, say, 50 grains, or we begin to have trouble from foaming.

There was never any injury to the boilers whatever, so far as their experiments showed.

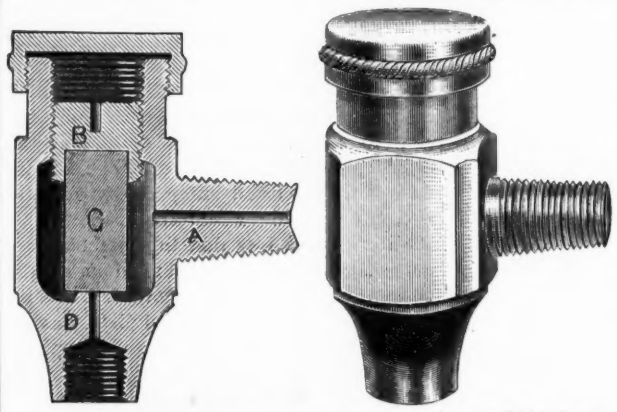
Upon the question of washing out boilers, he said:

All our roundhouses are provided with hydrants and high-pressure steam connections, for the purpose of obtaining a powerful stream of hot water for washing-out use. On Eastern divisions, locomotives having run from 1,500 to 2,000 miles are blown off at low pressure, cooled, and the stream of hot water thrown in at hand holes, front tube sheet and back head, and scraper worked in and out. The sediment is found mostly loose and in the form of fine mud, to the amount of 10 or 15 buckets full. After thorough cleaning the boiler is again filled with hot water and is ready for service.

On the western divisions we have to increase the frequency of washing out, doing so as often, sometimes, as once every 300 or 400 miles run. As to the economy of using hot water always, there can be no question; we are saving fully 75 per cent. in number of cracked fire-box sheets by this practice alone, and have been able to materially reduce our force of repairers in roundhouses, notwithstanding a very large increase of engine mileage.

In the discussion that followed the reading of this paper, Frank C. Smith said:

On the road with which I am connected we tried common coal oil. We fitted three engines with tin tanks on the running board in the cab, and connected them with the feed pipe, and adjusted the valve so that the engine in running 120 miles would just draw two gallons into the boiler. We did that eight weeks ago, and the result has been that the scale has been entirely dissolved and washed out in the form of mud. I do not know how it would be with other waters, but that has been the effect from Peoria to Evansville.



Jenkins' Automatic Air Valve.

The accompanying cuts represent full size, in perspective and section, a new automatic air valve for steam radiators.

Jenkins' packing in its various forms is probably familiar to most of our readers, having been in use for years in making steam joints, and for other purposes. A new use has been found for it in this valve.

Referring to the sectional view, *A* is the inlet, *B* a screw for setting the valve, *C* an expansible elastic plug, and *D* the outlet tapped to connect a drip pipe, or cup.

The principle upon which air valves operate is, of course, familiar. Most of them depend upon the contraction of a piece of metal to open them for the admission of air when the steam is shut off from the radiator. Many of them involve considerable complication and uncertainty of action.

In this valve steam enters at *A* and surrounding the plug *C* (which is a special form of Jenkins' packing) expands it. Then the screw *B* being screwed down so as to bring the plug to its seat, when the steam is cut off the plug contracts and opens the valve.

The composition of the plug is such that it makes a tight joint at the seat, by reason of its elasticity, and at the same time its ratio of expansion is very great, so that only a short plug is needed to secure ample opening. It will be seen that the construction is extremely simple and its action direct.

They are made of brass, nickled, and are manufactured by Jenkins Bros., New York city.

The shirtmakers' societies of New York will be instrumental in presenting a bill to the legislature prohibiting laundry work on the contract system in the State prisons of the State.

There appears to be quite a revival in Britain in the shipbuilding trades.

Early Engineering Reminiscences.

BY GEORGE ESCOL SELLERS.

THIRTY-SIXTH PAPER.

On that day, on turning the steam on the last charge of one of the guns a steam pipe burst, and the boiler pressure rapidly fell and could not be maintained at over 150 pounds. It would be useless to discharge the gun with only that pressure, and as repairs could not be made without cooling down, I had the fire drawn, leaving the valve between the boiler and gun with its charge of cane open, that the steam in boiler and gun should go down together, with the intention of firing up in the morning and blowing out the charge when I left the works; in less than half an hour after the accident the steam had dropped below 100 pounds. The next morning, to see the condition of the cane before turning on the steam to blow it out, I opened the gun door and found that the cane had settled so as to not more than one-half fill the gun chamber, and was in so soft a condition, that it could not be taken out without parting at the joints, and could be rubbed between the palms of the hands into the fiber strings like those discharged from the guns.

I find in my notes made at the time, that this greatly discouraged me with the steam gun process, for the natural question was, is the disintegration due to the flashing into steam of the confined sap, or the softening of the cane by steam digestion and the violent contact with the air on the discharge when in that state? The fact that thirty minutes' exposure, under a pressure of 200 pounds, was the shortest time that anything like regularity in a disrupture into the long strings of fiber could be depended on, and that better results were obtained with wet than with dry superheated steam, all pointed in the direction that it was simple digestion that did the work. This led to a series of experiments, using one of the guns as a digesting chamber; it was charged with cane, and, after being submitted to 200 pounds steam pressure for thirty minutes, the steam was shut off, and that in the gun allowed to escape slowly, to avoid the sudden flashing into steam of the internal sap. On opening the gun the cane was found to be much softened. As soon as cool enough to handle, I split a section between the joints into slivers, tied them into a bundle of a size that I could force into the barrel of a common musket, then with a light charge of powder, fired in the open air. This experiment was repeated several times, resulting in every instance in a more perfect disintegration of the wad or bundles into the long fiber strings than when discharged from the steam guns. This led to a series of experiments in steaming or digesting cane, using one of the guns as a digester. First the gun was closed, the cane that had been submitted to the 200 pounds pressure for thirty minutes again had the steam turned on at the same pressure, and thirty minutes more given it, when the steam was let escape in the same cautious way, the gun opened and the charge examined. Instead of being softer, as I expected, it was, if there was any change, harder and much darker in color. The gun was again closed, and the 200 pounds pressure kept on for an hour. By this time, notwithstanding the moisture of the steam, the heat of 380° had been sufficient to convert the entire charge into what the French gunpowder makers call "carboneux" and in a good condition for making sporting powder. The room was cleaned, steam turned on, and this charge blown from the gun. All the resultant that could be swept up was dust and small fragments of charcoal.

From all the gun experiments, the best results as to quality of fiber, color and strength, was by steaming from one to two

hours under low pressure, never exceeding eighty pounds, suddenly raising to a high pressure and discharging. While the guns were being worked, a pungent ether smell was perceptible, often as much as a mile from the works. It had a stupefying effect on the men working in the gun room, and I could never remain in the room long at a time without a spell of vertigo. A phenomenon of the gun discharge was an electric light or flash from the muzzle. This I first noticed at night, but it was frequently light enough to be seen by daylight. To arrive at more accurate results than I could by using the guns as digesters, I had constructed a pot digester so arranged as to measure with accuracy the steam pressure, as well as the degrees of heat and moisture, and crushing rolls to separate the fibers.

We had accumulated a large quantity of the product of the guns in the shape of crude or long tangled strings of fiber. The paper mill was ready to operate, with an experienced foreman secured, who had got together skilled workmen for all departments. Under these circumstances we concluded to start the mill and use up this stock in making wrapping paper, as nothing had been practically done toward an ultimate separation, purifying and bleaching. I had, in a small way, with hand paper mould, tested the felting property of the crude cane fiber, and believed that sufficient strength for ordinary wrapping paper could be had without the brittle harshness of the lime-prepared straw paper. But in this I was greatly disappointed; there was not sufficient strength in the wet paper to pass from the press rolls of the forming machine to the drying cylinders without frequent breakage, even breaking by shrinkage on the drying cylinders. The paper was smooth, with a silk-like feel, with none of the harshness of straw paper, but totally lacking in strength for wrapping paper. It was a superior blotting paper. Some strength was gained by resin-sizing in the engine, but before the paper could be put on the market with any hope of success in its introduction, a mixture of about one-fourth in weight of manila rope stock was added. This produced a superior quality of wrapping paper, darker, and differing in color from manila paper, but of a grade so little below it, that, at the then price of paper, the mill could be made self-sustaining while experiments were being carried on in the ultimate separation of the fibers, purifying and bleaching, so as to retain them in their utmost integrity, and the invention and perfecting the necessary mechanical appliances. In handling with a pitchfork, the crude fiber of the guns from the stacks of it to the beating engines, clouds of almost suffocating dust arose, and large quantities were shaken from the mass, fully equaling in weight the fiber that went into the beating engines, and that was far from being free from it, and, being of a non-fibrous character, would fill interstices, but at the same time lessen the strength of the paper.

Here was an unlooked for wastage; first we lost fully 15 per cent. of the green cane by its moisture; now of the remaining 85 per cent. fully half was gone in this worthless non-fibrous matter, and how much more would be lost in the preparation for and bleaching, who can tell? Having reached this discouraging state of affairs, my new digester and crushing rolls being ready for use, although feeling greatly depressed, I undertook the critical investigation that I should have done previous to having entered into the business.

That I may be better understood, let any one cut a transverse section of a cane fishing rod, and the wood body around the internal cavity will present a series of circular dots, plainly to be seen by the naked eye, but better with a common hand magnifying glass. These dots are smallest near the outer silicious coating of the cane, and are closely compressed together; they grow larger towards the middle of the ring, with a greater space between them, and are lost or faintly marked before reaching the inner cavity. These dots are the ends, or represent the ends of the long strings of fibers as produced by the gun process; the spaces between them are the non-fibrous portion, that is, the cementing material that binds the fiber string together, and are much the larger portion of the stems of the plant, which is one of nature's most economical expenditures of material in producing such a structural plant as to sway under, and without injury withstand the gales the cane brakes are liable to.

My first experiments were directed towards arriving at the best results in softening by steam digestion, as to the pressure and time required; then separating into the long strings by passing between crushing rolls and washing; next into a more perfect and ultimate separation of the fibers by bringing the mass into a proper condition for a second crushing process. In the examination of cane as a proper stock, these experiments were made joint by joint, commencing near the root, and proceeding to the upper end. It soon became evident that, as we approached the top joints they produced less fiber to a given weight, and that several of the top joints were utterly valueless. The same was found to be the case with limbs and branches; this involved the necessity of cutting and stripping—a slow and costly process by hand labor—and necessitated the invention of a stripping machine, to be operated by steam or horse-power. This was perfected, and became the subject of a patent, and was put in operation at the works, the leaves and small branches being worth the cost of transportation as food for stock. Notwithstanding this saving in cost of labor, we were not able to reduce the cost of cane at the works below $13.00 per ton.

Microscopic examination of the ultimate fiber showed them to be cellular, with very fine terminal ends; if these cells contained sap or liquid, I failed to find a single instance of disruption such as would be produced by a flashing into steam. The fine long terminal ends forbid the ordinary treatment for straw or wood by caustic alkali, as it at once destroyed these fine thread-like terminals, and with them their best felting property, to say nothing of the waste. I experimented extensively and successfully in preparing the fiber for bleaching by fermentation in a liquid extract of maize, a much cheaper process than the alkali, inasmuch as the liquid can be utilized by distillation.

While these experiments were going on, on the 11th of September, I received a letter from Horatio Allen, announcing the death of his brother, Geo. F. Allen. This was followed by another letter stating that he and his friends had parted with their interests in the Lyman patent, to the promotor of the new company—who about the same time wrote to my associate that they were then in condition to make such favorable terms with me as to the grant that he believed we would accept. On this letter being forwarded to me, and having fully satisfied myself that there was no value in the process, I felt ready to accept any terms that would cover some of the loss I had incurred. I went East, and with my associate, to New York. This time we had a more civil reception, and, on our declining all propositions for a union in interest, and a further prosecution of what I felt satisfied would result in failure, the result was that we surrendered the grant on their paying us the original cost of the two disintegrating guns, adding the cost of transportation, mounting, and other expenses fairly chargeable to them. What became of them and of the theory on which they were claimed to operate, I know not, but had the results anticipated from them been realized, I think that I and the entire world would have heard of it. But in being rid of the guns we were not rid of a paper mill, neither well located nor calculated for a rag or a straw mill.

From the experiments I had made with my small digester and crushing rolls, I thought I saw some ultimate value in the non-fibrous portion of the cane, which, if it could be utilized, the value of the cane brakes as a source of paper stock would be no myth. The entire success of my experiments with digesting, crushing, washing, fermenting and bleaching were such that I took out a number of patents to secure me in them. I therefore turned my attention to what I have referred to as the non-fibrous portion of the plant, which the microscope showed to be as perfect a cellular organism as the fibers. To this substance I gave the name of arundin, from the botanic name of the plant. This substance, with a small admixture of either resin or animal size, and submitted to a heavy pressure, will form a solid, compact mass, of a beautiful brown color, of about the hardness of horn, and susceptible of taking a high polish, and well adapted to many of the uses that papier maché is applied to; for the ornamental work on picture frames a lasting substitute for putty. But the principal use I proposed applying it to was bookbinders' boards, and for this purpose I devised a machine that, in a single operation, would sufficiently compress the arundin and coat it on either or both sides with any given thickness of cane fiber, or, where greater strength was required, a mixture of hemp fiber; the object of this outer coating being to give a surface sufficiently yielding to take the impression from the embossing tool.

By a hand process, instead of automatically-working machinery, I produced a few specimens, which I gave to Mr. J. B. Lippincott, of Philadelphia, who expressed himself as favorably impressed, and suggested some points that he thought would work important improvements in book-binding. Feeling encouraged in so far having succeeded, though in a small way, of finding a use for the heretofore great waste, I prepared to test it on a sufficient scale to demonstrate its value for that purpose, and to keep the mill running on cane wrapping paper, I had constructed a powerful cutting machine, into which cane in large bundles could be fed and cut into lengths of about 2"; also a boiler or digester that would carry over one ton of this cut cane. This digester I had made three times the length of its diameter, with round ends, one of which opened with a large circular manhole plate. This digester was so hung as to swing on its short axis in revolving; in that manner the charge of cane was tossed about more thoroughly than had it turned on the long axis as paper makers' rag boilers do. Besides this advantage, when the manhole was up and immediately under a bin into which the cut cane was elevated as cut, the charging was but the work of a moment by simply opening a gate, and when the digestion was completed it was discharged with the same facility; by turning the manhole end down the contents were discharged into a vat made to receive it; the steam passed into the digester through hollow axis, and by pipes was carried to and discharged into it at the end opposite the manhole. The digested cane was taken from the vat and passed between crushing rolls; from them into a picker, or devil, that loosened up, tearing apart the mass as it came from the crushing rolls. In this state it was used for making wrapping paper, only washing out by rotary washers in the beating engine so much of the arundin as would weaken the paper, and leaving in all the paper could carry, filling the interstices, increasing solidity, and making a fine surface finish; in fact, taking the place of the kaolin used in making white paper.

From the time the digester was put in use the yield of the paper mill was greatly increased. The steam boiler, that was not adjusted to work the steam guns with forced firing, made all the steam required with light firing to work the digester, run the cane cutter, crushing rolls and picker, preparing fiber in a better condition for the wrapping paper we were making, and in quantity fully six times the amount we had ever been able to produce by the guns in the same time.

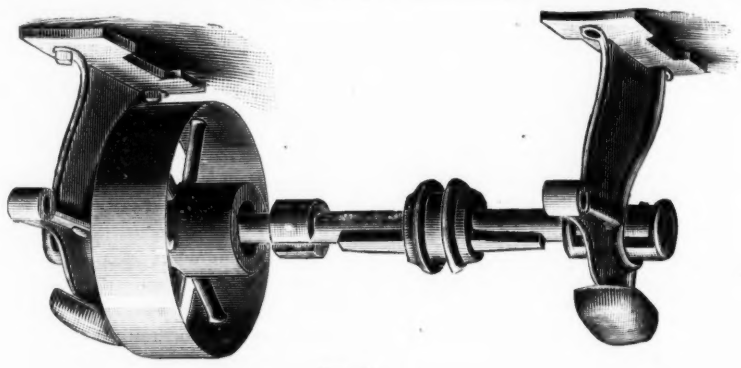


FIG. 2.

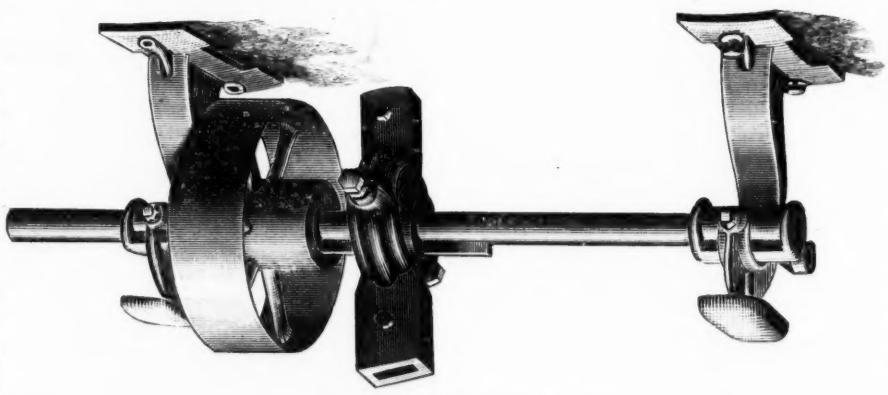


FIG. 1.—NEW FRICTION CLUTCH.

Jones & Rogers' Friction Clutch.

The accompanying illustrations, Figs. 1 and 2, show a friction clutch which is quite simple in construction, and which we are informed has given very good results in use.

The split ring shown on the shaft, Fig. 2, is pinned or keyed to the shaft, and is made an easy fit in the counterbored hub of the pulley. The tapered steel wedge is guided by the sliding collar, and always rests in the split ring half way. The split in the ring has the same taper as the steel wedge, which is made so as to be used for two pulleys, as in the case of lathe countershafts. In operation the slight movement of the wedge into the split ring easily expands the ring in the hub of the pulley, making a sure friction grip.

The pulley is shown slipped off from the split collar, to show the construction.

The style shown in Fig. 1 is for line shafts, whereby the driving pulley and belt is stopped at will, and, by means of a sleeve attached to the hanger bearing, the weight of the pulley and belt is removed from the rotary shaft, thus preventing all wear on the pulley bore when standing, and relieving the shaft of needless work. The builders are Messrs. Jones & Rogers, Cincinnati, Ohio.

Eleven employes were killed and 111 injured while coupling or uncoupling cars in Massachusetts last year.

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NEW YORK, FEBRUARY 18, 1888.

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Cheating Nature.

However rapid the rate of progress in the arts and sciences may become, there is little doubt but there will always be some enthusiastic individuals who will consider the march of progress entirely too slow, and be tempted to draw upon their imaginations for a more rapid advancement.

There are some such people amongst us to-day, and during the flights of imagination in which they indulge in their efforts to surpass the rest of mankind, they are by no means hampered by the consideration of such homely matters as natural laws, but regard as mere shadows, conditions which the skilled but prosaic engineer or mechanic would at once declare to be insurmountable obstacles.

As a young child outstretches its hands toward the moon, in the full belief that it has but to reach and grasp it, so these dreamers, innocent of all knowledge of scientific and mechanical laws bearing upon the subject of which they dream, conceive to be within easy grasp achievements which it is well known can never be reached without disproving laws which are as well established and as indisputable as the axioms of the mathematicians.

We are constantly hearing of some new scheme which is to revolutionize present practice, and by which nature is to be made to transgress her own laws.

Anything which is conceived to be desirable is at once believed possible, no matter how impracticable the means by which it is to be accomplished.

Since time immemorial, men have striven to invent a perpetual motion, and have declared it to be practicable, in the face of well known and irrefutable laws to the contrary, and there is no reason to suppose that the number of such misguided individuals will in the future be any less than in the past.

But there are many who, notwithstanding they fully recognize the impossibility of perpetual motion, yet place full confidence in some other scheme for cheating nature, hardly less fallacious and absurd.

By chemical, electrical, and mechanical means, as well as by speculative operations, men are continually striving to obtain something for nothing. By speculation they sometimes succeed, but by no possible scheme can nature be cheated; her laws are universal, inexorable, and self-operative, and he who hopes, in any way whatever, to avoid them, deceives himself, and those who put their faith in him.

The Copper Syndicate.

It seems that the copper syndicate, about which so much has been heard recently, is a good deal of a reality. With its head in France, and ramifications extending into every copper-producing country, it seeks, of course, to make its own prices for the copper used by manufacturers, and in the majority of houses in the civilized world. According to recent reports, there is an immense capital invested in the scheme, and so far there has been reasonable success in its operation. But there is one thing in the way of keeping copper at unreasonable prices—if that is the intention—that perhaps has not received due consideration. That is, there are a good many copper mines in the world that are not being worked at present, but which could be worked at some profit upon the basis of a slight advance in price. It is hardly probable that the syndicate will ever be able to control all, or even a majority of these mines.

If, then, the copper syndicate, as in a case of manufacture cited by our correspondent, Mr. Tramis, in another column, should turn its attention to methods by which the cost of copper will be cheapened to the user, no one will have much ground for complaint, even if the syndicate does make a good deal of money in its operations. If, on the other hand, as is more likely from present knowledge, the intention is to control the output so as to permanently and materially increase the price, there is likely to be such competition from new mines, and from old ones re-opened, as to defeat the scheme. It is doubtful if the copper syndicate, whatever the intention, can work much harm.

Asa Gray.

In the life and labors of Prof. Asa Gray, who has recently died at a ripe old age, covered with the honors earned by long years of patient study and devotion to science, is to be found an example which our young readers may well seek to emulate.

Without the early advantages of education and training which many deem indispensable to success in the pursuit of scientific studies, he has yet made his name known throughout the world of science; the history of his life being practically the history of the development of the science of botany.

He has left behind him a reputation which is an enduring monument, of what can be accomplished in almost any field of learning, by exalted enthusiasm, absolute devotion, and tireless industry.

In the contemplation of his career we hope many young men will receive encouragement to make the best possible use of their talents and abilities. Of course we do not pretend to say that every one can equal his success, but the point is that Asa Gray simply made the best possible use of the natural talents with which nature had endowed him, and very few who do that will have much reason to be dissatisfied with the result.

A controversy has been going on for some time between the railroads and the manufacturers of steel rails, the railroads insisting upon prices somewhat less than rails could be imported for, which manufacturers claimed left them no profit. The result was the closing of many steel rail mills—very unpleasant prospects for the year for both manufacturers and workmen. But a compromise has been reached, on prices that the manufacturers are willing to accept, and many orders have already been placed, with prospects of many more to follow. Altogether, the outlook for steel rail manufacturers is good. There is plenty of room for the laying of all the steel rails that the rail mills of the country can make for some time, and with the present tariff on steel rails, satisfactory prices should be arranged between users and manufacturers.

Our esteemed contemporary, *The Paper Trade Journal*, shows an excellent sense of discrimination in reproducing from the AMERICAN MACHINIST the articles on "Early Engineering Reminiscences," by Geo. Escol Sellers. But it shows—let us hope—forgetfulness in failing to give proper credit for the matter appropriated. We presume it is an oversight on the part of our contemporary that the customary credit is not given.

The marine engineers of New York and vicinity are moving for higher pay. They claim that they work 19¾ hours per day, Sundays included. We advise them to move for shorter hours; 19¾ hours is long time enough for two engineers who need to be as alert as marine engineers in crowded harbors. When an accident happens through neglect of an engineer the plea of long hours does not avail.

Literary Notes.

CONDENSED SUGGESTIONS FOR STEEL WORKERS, is the title of a little book of 28 pages, and small enough to be conveniently carried in the pocket, issued, we suppose, for gratuitous distribution, by Miller, Metcalf & Parkin, Pittsburgh, Pa. It contains a good deal of useful information on selecting, annealing, forging, hardening and tempering steel. After the hints for working steel, the little work concludes with a few words, as follows, that are worthy of extended publicity:

Finally—the art of working steel can be acquired only by *intelligent* application.

Some will never learn, and others seem to be imbued with the idea that twenty or thirty years' practice must necessarily qualify them as experts. In point of fact, something new can be learned every day, and he is wise who will lay aside prejudice and change his mind whenever occasion requires it.

The Street Railway Gazette, Chicago, Ill., began the year with a new dress and various other evidences of prosperity. It gives its readers, monthly, a large amount of interesting reading matter. The New York office of the *Gazette* is at 181 Broadway.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(73) E. C., Camden, Ark., asks: 1. How can I remove stuff that has accumulated for years on and between boiler tubes? *A.*—We believe, from your communication, that the best thing to do is to remove the tubes and clean them; then if the tubes are found good, piece out and replace. 2. Of what is a bath composed for annealing the ends of boiler tubes? *A.*—Heat the end of tubes, and stick them in a bed of lime to cool.

(74) C. M., Syracuse, N. Y., writes: Could you please inform me where I could get an illustration or a drawing of a compound type of engine where one cylinder is placed on top of the other? *A.*—You will find a drawing of this class of engine in "Modern American Marine Engines, Boilers and Screw Propellers," by E. Edwards There is also a very neat illustration given in the advertising pages of the *Engineer*, January 6, 1888, p. 5; although only one view is given, it indicates the general design of the engine.

(75) A. A. L., Johnstown, Pa., asks: 1. What should be the circumferential speed of a milling cutter, in feet, working steel, iron, and brass? *A.*—For steel from 30 to 75 feet per minute, according to character of steel and of cut being taken. For iron about the same. For brass from 100 to 300 feet. No definite rules can be given in such matters which will be universally applicable. 2. What is the proper speed for planing such metals on a planer. *A.*—Planers are usually speeded at 20 to 25 feet per minute, but if a planer were to be used exclusively on brass it might be speeded as high as the machine itself would stand.

(76) C. F. H., Buchanan, Mich., writes: We are using a hot water heater to warm our offices, and wish to ask your opinion as to whether we are having economical service from it. The main office contains 8,000 cubic feet of space with glass front 20 x 14 feet exposed to the west, and one side 28 x 14 feet next to our showroom, which is not warmed. The remainder of walls are brick and wood, plastered. The second room has 4,000 cubic feet of space and not much glass. When outside temperature is 10° below zero it requires 100 pounds of hard coal per day of 24 hours, maintaining a temperature in the room of 70° to 75°. Is this a favorable result? *A.*—We should think the result was very good.

(77) G. P., Norwich, Conn., writes: Our cupola is charged every day with the same kind of coal, and no slag appears except when it is tapped out too large, then it shows great quantities. What is the cause? *A.*—L. C. Jewett says: "The slag is there the same, whether the hole is large or small. The reason it is seen when the hole is large is because the large hole is higher in the breast and the iron gets below the top of the hole, so that the slag, which is always top of the melted iron, flows out. I have practiced in order to purge a cupola of slag in long heats, the following: Draw down as low as possible with regular tapping hole, then take away the ladle without stopping up, punch a large hole in the breast and let the slag out. Then stop up and go on as usual."

(78) C. L., New York, writes: 1. Please tell me a simple process by which I can know that a lathe is set straight. *A.*—The simplest process is to take a trial cut and test it with calipers. 2. How have I to set my center-rest when I wish to do a good job? *A.*—Set it so as to be exactly in line with the centers. One way of doing so is to turn a place on the work where the rest is to be applied. Then put on the rest and adjust it so the tail center will be in line with the center made in the end of the work. 3. If a nut is given to me, and I am to cut a thread on a shaft to fit it, how am I to measure the inside of the nut so as to cut the thread the right size. *A.*—Most all nuts have a normal size, and you can turn the shaft to that size and then fit the thread by repeated trials Or if the tap is at hand you can caliper it.

(79) R. M., Warren, Pa., asks: 1. Is there any automatic engines made that will govern as closely as within two per cent.? say running with 80 pounds steam cut-off at one-quarter stroke, if the steam pressure is reduced to 60 pounds will the engine run at the same speed? *A.*—The

load remaining the same, the speed will not be the same, but there are builders of automatic engines that will guarantee less variation than two per cent. under the conditions named. 2. Will engines govern as closely under variations of steam pressure as under variations in load? *A.*—Some may, but generally they will not, because the variation in steam pressure generally varies the work that the governor has to do in controlling the speed. 3. Will an engine 16″ x 24″, running 82 revolutions belted direct to line shaft, cutting off at ⅛ stroke, use more steam than one 9″ x 12″, cutting off at ¾ stroke, speed 270 revolutions? *A.*—The small engine cutting off at ⅜ stroke would, supposing both engines to be properly proportioned, and running non-condensing, do materially more work than the large one at the slower speed. Assuming the small engine to do the same work as the large one does when cutting off at ⅛ stroke, with, say 80 pounds steam pressure, then the small one should use the least steam because the large one is greatly under-loaded, and an under-loaded engine is the reverse of economical in its operation.

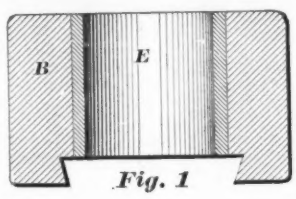


Fig. 1

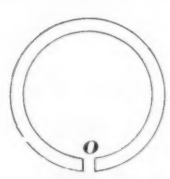


Fig. 2

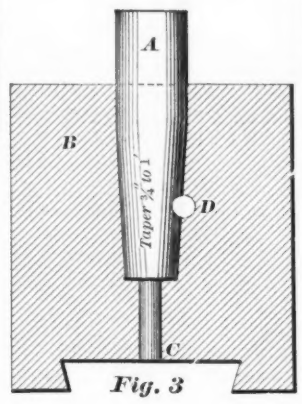
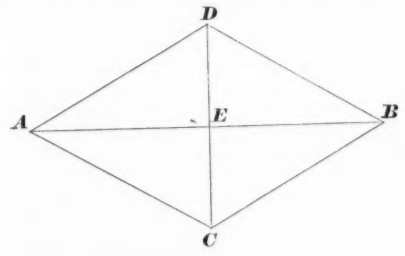


Fig. 3

(80) C. A. H., Hamilton, Ont., writes: Will you please give me an answer to the two following questions? 1. If a wire rope were stretched across a span of 300 feet with a sag of 4 feet, what would be the stress on the rope if a weight of 500 pounds is hung in the middle of the rope? *A.*—Assuming that the sag remains 4 feet after the weight has been hung in the center of the rope, and leaving the weight of the rope out of question, then the stress on the rope will be 9,406.25 pounds. 2. Give me a rule for working out such problems for different lengths of spans, with different sags, and with different weights suspended. *A.*—In this answer we shall refer to the accompanying illustration, which is not drawn to a scale. Draw a straight line *A B* and make the distance between the extremities *A B* equal to the span, namely 300 feet; through the center *E* of this line draw the perpendicular *D C*, and make the distance between *E* and *C* equal to the sag, 4 feet; join the points *A* and *C*, and also *C* and *B* by straight lines. Through the point *A* draw a line *A D* parallel to *C B*, and through the point *B* draw a line *B D*, parallel to



A C, both lines cutting the line *C D* in the point *D*. The parallelogram *A B C D* thus formed is called the parallelogram of forces, in which the length of the line *C D* will represent the number of pounds hung at the center of the rope, and the length of the line *A C* will represent the stress in pounds on the wire rope. Consequently, the stress on the rope will be just as much greater than the weight hung on the rope as the line *A C* is greater than the line *C D*. Our next step will be to find the length of the line *A C*. The triangle *A C E* is a right-angled triangle, and since we know that the length of the side *A E* is 150 feet, and the length of the side *E C* is 4 feet, the length of *A C* is easily found, for we have only to add the square of *A E* to the square of *E C*, and extract the square root of the sum; the answer will be the length of the side *A C*, or the hypothenuse of the right-angled triangle. This rule may be found in any elementary geometry. Hence we have

$$(150 \times 150) \times (4 \times 4) = 22{,}516 \text{ and}$$
$$\sqrt{22516} = 150.5 \text{ inches} =$$

length of the side *A C*. Now, since the stress is as much greater than 500 pounds as *A C* is longer than the line *D C*, we find the stress on the rope by simple proportion, thus; 8 : 150.5 : : 500 : answer. Working out this proportion we have 9406.25 pounds for the stress on the rope. If the weight of the rope is to be taken in account, add the weight of the whole rope to the weight hung upon it, and let the line *D C* represent the sum of these weights, and then proceed as before. In a similar manner all problems of this kind can be solved.

(81) G. J., West Melbourne, Australia, writes: I have several steam hammers to make for the Victoria Gov. Railway Department, and our locomotive superintendent is a gentleman who has been a long time in the United States, and he says the best means of fixing the hammer head to piston rod end is the one adopted by Messrs. William Sellers & Co., Philadelphia, but he forgets exactly how it is done; will you kindly send me a sketch. *A.*—Messrs. Sellers & Co.'s method of fastening the hammer head to piston rod end is shown in Figs. 1 and 2. A wrought-iron bushing *E* is placed in the hammer head *B;* this bushing is cut open throughout its entire length, as shown at *O*, in Fig. 2, the amount of opening being about ¼ of an inch. The hammer head with bushing is shrunk on to the piston end. Other makers generally adopt the method of fastening the hammer head to the end of piston rod, as shown in Fig. 3, in which *A* is the piston end and *B* the hammer head. The straight part of the piston rod extends into a hammer head brough a distance of about two or three inches, after which it is tapered, about ¾ of an inch in 12 inches. The piston rod is driven into the head by two or three smart blows, and then further secured by the pin *D*, for which part of the piston rod end is cut out, usually by means of a rose bit, after the piston rod has been driven into the head. The pin *D* often extends through the whole thickness of the head, and is slightly tapered. The hole *C* is for the purpose of driving the piston rod out when that becomes necessary. The illustrations are not drawn to scale, as they are simply intended to show the method of fastening piston rod to head.

(82) F. L. N., Boston, Mass., writes: Please inform me what preparation is used to stick cloth together, or cloth to wood or bone, as used by fan makers; something that does not soil the cloth. *A.*—We do not know the preparation used by fan makers, but it seems to us that a few drops of glycerine in a small bottle of mucilage will give a preparation which will answer the purpose. The object of adding glycerine to the mucilage is to remove the difficulty of making things stick to highly polished or varnished articles. Too much glycerine must not be added to the mucilage, as it will prevent the mucilage from hardening. The soiling, it seems to us, can only be avoided by handling the articles carefully.

(83) J. G. L., New York, writes: A and B see a chance to improve an existing business by getting up a machine, by which the output of the shops will be about six times greater than formerly, thereby cheapening the cost of production. A agrees to invent and design the machine, B to pay him a draftsman's wages meanwhile, and furnish cash for the construction of the machine. A is to run the machine and be guaranteed a mechanic's pay for so doing, also to receive a percentage of the profits. The business to belong to B. We wish to know the fair percentage A should receive as inventor of the machine. *A.*—This is a question which we can hardly answer without knowing more of the circumstances. As it is stated, A runs no risk at all in the matter, and if, for any reason the machine should fail to meet your expectations, the loss would all fall upon B, a consideration which, of course, should have some weight. To offset this is the probable value of the machine as an invention. The balance between the two will depend upon the risk taken by B, compared with the inventive ability and skill furnished by A. If there is little or no risk, then B should be satisfied with a comparatively small share of the proceeds; on the other hand, if there is great risk, and small inventive ability or skill required, the apportionment should be arranged accordingly. It is the usual practice in such cases to divide the proceeds equally between the inventor and the one who furnishes the capital; though it is evident from the above considerations that such a division is not always a fair one.

(84) E W. A., Philadelphia, Pa., asks: Where is the proper place for a steam [heating] pipe, at the ceiling or at the floor, and which would require the most steam to heat a composing room? *A.*—Overhead heating is practical in many factories, and is held to be as economical as heating from near the floor. The overhead pipes should not be too near the ceiling, and should be arranged by some one acquainted with steam heating.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Planed bevel gears. Grant, see page 16.

Link-Belting.

Send for catalogue of Link-Belting.

Over 50,000,000 feet of Link-Belt in use.

Link-Belt Machinery Co., Chicago and N. Y.

Engine lathes, 17″ to 38″ swing, Lodge, Davis & Co.

Cabinet turret lathes, Lodge, Davis & Co.

Shapers, 15″, 20″, 26″, 32″, Lodge, Davis & Co.

Upright drill presses, Lodge, Davis & Co.

See "ad." pages 15 and 16, Lodge, Davis & Co.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Lamb Knitting Machine Co., Chicopee Falls, Mass.

Machine work and patternmaking. Anderson Machine Works, Peekskill, N. Y.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

For Electric Recording Steam Gauge, write Telemeter Co., 44 Barclay st., New York.

The Best Upright Hammers run by belt are mad by W. P. Duncan & Co., Bellefonte, Pa.

The bulldozer forming, forging and bending machine. Williams, White & Co., Moline, Ill., m'f's.

For catalogue of 2d hand lathes, planers, etc., write to John Steptoe & Co., Cincinnati, O.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

Solid Nickel-Seated "Pop" Safety Valves. Consolidated Safety Valve Co., 111 Liberty st., N. Y.

R. Dudgeon, 24 Columbia st., New York. Improved Hydraulic Jacks and Roller Tube Expanders.

Davis Key-Seating Machines, kept in stock, by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

For first-class automatic engines write to Williams Engine Co., 447 North street, Baltimore, Md.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

"How to Keep Boilers Clean." A book, mailed free, by James E. Hotchkiss, 120 Liberty st, N. Y.

Ice and Refrigerating Machines, 124 built, and all successful. David Boyle, 521 Monroe st., Chicago, Ill.

Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

Drawing Materials, all kinds. Get catalogue. Mention this paper. G. S. Woolman, 116 Fulton st., N.Y.

Burnham's New Improved Turbine; sold at cost of manufacturing and advertising. Address York, Pa.

Pattern Letters and Figures to place on patterns for castings. H. W. Knight & Son, Seneca Falls, N. Y.

The Improved Tabor Steam Engine Indicator, made and sold by The Ashcroft Mfg. Co., 111 Liberty st., N. Y.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large; prices low. Frasse & Co., 92 Park row, N. Y.

For the latest improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.

Gears, racks or ratchets, all sizes, cut or furnished. E. E. Garvin & Co., manufacturers, 139-143 Center street, New York City.

Berryman Patent Feed Water Heater and Purifier, and the Economic Boiler Feed Pump. Benj. F. Kelley, 91 Liberty st., New York.

Nicholson & Waterman, Providence, R. I., two 48 in. horizontal boring mills; 5 in. cutting-off machines; 14, 16, and 30 in. engine lathes.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa

Mechanical drawing, calculations, etc., taught by mail; just what the young mechanic needs most to know. I. D. Boyer, 324 E. 3d street, Dayton, O.

Quints' Pat. Auto. Steam Engine Governor. Correspondence solicited from mfrs. of Throttle Gov'nr Engines. Leonard & McCoy, 118 Liberty st., N. Y.

Curtis Pressure Regulators, Curtis Return Trap, Curtis Damper Regulator. See Feb. 11, p 10. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

The Brown & Sharpe Mfg. Co. have placed at No. 23 S. Canal st., Chicago, Ill., a sample line of milling machines and other machinery with S. A. Smith.

Machinists' supplies, brass goods, m'f'rs' supplies, polishing materials, all kinds wire, metals, etc.; in any quantity. Jordan & Gottfried, 208 Canal st., N.Y.

For Best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th st., N.Y. Send for des'n.

The Holly Manufacturing Company, of Lockport, N. Y., will send, on application, their pamphlet, illustrating pumping machinery and reports of duty trials.

Only a few more left, therefore you should send 14 cents at once and get a copy of our 300 page illustrated catalogue. Montgomery & Co., 105 Fulton street, New York.

Patents relating to machinery should be secured by experienced mechanics acquainted with the law. Write to A. K. Mansfield & Co., mechanical engineers and patent experts, 280 Broadway, N. Y.

W. H. Hoffman, consulting engineer, 94 Liberty st., N. Y. Mechanical engineering in all its branches; working drawings for the transmission of power by steam, water, air and electricity.

New book on gears; Tables giving 3,094 diameters, with rules for calculation of movements of shafts, etc.; sent on receipt of P. O. Note: price, 50 cts. Address C. B. Long, M. E., Worcester, Mass.

Parties requiring milling machine or screw machine work furnished, in large or small quantities, will please write to the manufacturers, E. E. Garvin & Co., 139, 141, 143 Centre st., New York City.

Hot Water Supply. A practical treatise on the fitting of hot-water apparatus for domestic and general purposes. By F. Dye. 82 pages, with 25 illustrations. 12mo., cloth, $1. Send for catalogue. E. & F. N. Spon, 35 Murray st., N. Y

Wanted—Numbers 1, 2 and 4 of volume IV., 1881; must be in excellent condition for binding; if soiled we cannot use them; for copies described as above we will pay 25c. each, and prefer to have the whole three if possible. Parties favoring us will kindly write name and address on wrapper. AM. MACHINIST Publishing Co., 96 Fulton street, N. Y.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price, $2, postpaid. Published by John Wiley & Sons, 15 Astor Place, New York.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers, the full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G CO., 96 Fulton st., New York.

Fraser & Archer, general machinery dealers, have an excellent assortment of 20, 25, 26, 28, 36 and 38 inch upright drills in stock, which they are offering at extremely reasonable prices. It will pay any one in need of drills to communicate with them before making their purchases elsewhere. Any one interested in iron and wood machine tools would be repaid by a visit to inspect the complete line at their warerooms, No. 121 Chambers st., N. Y.

The series of articles by J. G. A. Meyer, on "Practical Drawing," now running in the AMERICAN MACHINIST, should be closely followed by every student. They commenced with October, 23, 1886 issue, and up to and including January 14, 1888 issue, 41 articles have been so far published. Copies containing these articles, sent by mail to any part of this country or Canada, at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton street, New York.

"Modern Locomotive Construction," by J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, are attracting the attention of railway mechanics all over the world. Commencing with the June 27, 1885 issue, 56 articles have thus far appeared up to and including the January 21, 1888 issue. Copies containing these articles sent by mail to any part of the U. S. or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton street, New York.

MANUFACTURES

The Exposition Cotton Mills, Atlanta, Ga., expect to double their capacity.

The Helena Electric Light and Power Company has been formed at Helena, Ark.

Burlington, Kan., is offering great inducements to manufacturers who will locate there.

The Leeds Planing Mill Company, Leeds, Ala., propose to make additions to their works.

The Gainesville (Ga.) Compress Company has been incorporated, with a capital stock of $10,000.

A mill for the manufacture of woolen yarn will be built at Mossy Creek, Tenn., by A. C. Johnston and others.

The main building of the Southern Agricultural Works, at Atlanta, Ga., recently burned, will be rebuilt at once.

The Barton Pulverizing Company, Cartersville, Ga., will build works for pulverizing ores, and making mineral paints.

The Standard Compress and Warehouse Company has been organized at Pine Bluff, Ark. The proposition is to build at once.

The Alvord & Spear Manufacturing Company has been organized at Winsted, Conn. The company will manufacture piano stools.

The United States Rolling Stock Company, 35 Wall street, New York, is interested in building a large foundry and a rolling mill at Anniston, Ala.

New water-works or the extension of existing works are contemplated at Avon, N. Y.; Cartersville, Ga.; Vassar, Mich.; Scranton, Pa.; Seal Harbor, Me.; Ellicottville, N. Y.

The Electric Water Protective Company, 713 Broadway, New York, has issued a catalogue descriptive of its electrical process for preventing water overflow in all kinds of dwellings.

C. L. Jackson & Co., successors to Jackson & Tyler, Baltimore, Md., have issued an illustrated catalogue of machine tools, and shafting, hangers and pulleys. The catalogue is very complete, and fully illustrated.

Mark A. Rider has gone to Melbourne, Australia, to put up an ice plant for the Pictet Artificial Ice Company, of New York. The ice machinery was made by Robert Whitehill, of Newburgh, N. Y., and is to be placed in a lager beer brewery, the fittings for which go from this country.

C. E. Chandler has started a shop at 65 Oliver street, Boston, Mass., for the manufacture of the micrometer stand illustrated in the AMERICAN MACHINIST of January 28. He will also bring out and manufacture other small tools. He writes us that he is receiving many inquiries and several orders for the stand.

The Sandwich Manufacturing Company, Sandwich, Ill., employ upwards of 300 men making corn shellers, power feed grinders, etc. They recently shipped nine car loads of goods to South America, and have made large shipments to South Africa, and considerable shipments to New Zealand and the Sandwich Islands.

Sebastian, May & Co., Cincinnati, Ohio, write us: Our works were partially destroyed by fire on the night of the 21st, but this will occasion but a slight delay, as we expect to be at work again during the present week. At no time since we have been in business have we known the lathe business to be so brisk as at present; orders are coming in very rapidly, and we will increase our present facilities so that we may be better prepared to meet the demand.

A Pittsburg, Pa., dispatch is to the effect that the Pennsylvania Railroad has just placed an order for 50,000 tons of steel rails at $31.50 per ton. It is divided among the Cambria Iron Company, the Pennsylvania Steel Company, and the Carnegies of that city. Other large orders will be placed in a short time. The Chicago, Burlington and Quincy Railroad has placed an order in Chicago for 20,000 tons at a somewhat higher figure, on account of the increased cost of manufacture in the West. The placing of these large orders will make business active with the steel rail men.

A Pine City, Minn., dispatch says: There is a movement on foot among Eastern capitalists to reopen the Chengwatona copper mines. These mines were opened several years ago by J. Bennet Smith, of Wilkesbarre, Penn., and vigorously pushed for two years. The company acquired a large tract of copper lands, extending from Snake to Kettle Rivers, and the outlook was favorable for a rich yield of metal. The recent advance in copper has turned the attention of several capitalists to this point as being a very desirable locality, from its geographical situation, for mining on an extensive scale. There is no doubt of the richness of the mines.

The Sandusky, O., Improvement Company, backed by $1,500,000 of Eastern capital, have secured 750 acres of land in the western portion of the city, and have agreed to put up the following establishments: One engine and boiler or machine works, with capacity for employing 400 persons estimated cost, $150,000; one glass ware or iron works, with capacity for employing 500 persons, estimated cost $140,000; one chair works, with capacity for employing 150 persons, estimated cost, $125,000; one glass bottle works, with capacity for employing 150 persons, estimated cost, $75,000; one window glass works, with capacity for employing 50 persons, estimated cost $50,000; street improvements, water mains and street car lines, estimated cost, $50,000; natural gas pipe line from the Northwestern Ohio gas fields, estimated cost, $900,000.—*Iron Trade Review.*

Machinists' Supplies and Iron.

NEW YORK, Feb. 2, 1888.

Iron—American Pig—No change of importance has taken place in the condition of the market since our last report. We quote Standard Lehigh brands No. 1 X Foundry at $21 to $21.50, outside brands at $20 to to $20.50. No. 2 Foundry $19 to $19.50 for Standard Lehigh brands, but other brands are obtainable at $18 to $18.50, and Grey Forge ranges from $16 to $17.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate, 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Wanted—Men to sell planes, see page 11.

Wanted—A situation by an experienced foreman patternmaker. Box 82, AM. MACHINIST.

Draftsman accustomed to furnace and rolling mill work, wants position. Furnace, AM. MACHINIST.

Wanted—Situation as foreman or supt.; long experience; good designer. W. W., AM. MACHINIST.

Wanted—Situation as foreman boilermaker, by a man of experience on all kinds of boiler work; good references; age 33. R. W. O., AM. MACHINIST.

Foreman wanted who can manage about twenty-five machinists and get out engine work at lowest cost of good work. Address J. S. & Co., Lock Box 25, Manchester, N. H.

Wanted—Situation as foreman blacksmith; locomotive work preferred; great experience in Europe and America; great saving guaranteed; distance no object. W. J., AM. MACHINIST.

Wanted—Situation as foreman blacksmith by a pushing young man, with large experience in heavy forgings on stationary and marine work; good references. Blacksmith, AM. MACHINIST.

Engine salesman wanted; one acquainted with the trade in New York, Philadelphia and vicinity, to sell improved engines. Address D. R. R. & Co., care J. A. Emerick & Co., Philadelphia, Pa.

Wanted—A good machinist with push and executive ability; capable of handling about 30 men in general machine shop; no hurry; give age, experience and references. D., AM. MACHINIST.

Wanted—By energetic young man; situation as foundry foreman; large experience in heavy engine castings, coke, and anthracite irons; knowledge of brass; good references. Foundryman, AM. MACHINIST.

Wanted—In a thriving city of 30,000, accessible by five different railroads, schools unsurpassed; a machinist capable of taking charge of works now employing 25 hands, but will increase; must be sober, industrious, well up in automatics practically and theoretically, understanding thoroughly use of steam engine indicator, competent to make comprehensive working drawings; middle aged, with family preferred. To a suitable man a good arrangement will be made. Automatic, AM. MACHINIST.

✝ MISCELLANEOUS WANTS. ✝

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Crescent steel tube scrapers are unquestionably the best. Crescent Mfg. Co., Cleveland, Ohio.

Crescent boiler tube cutter, for setting new and removing old tubes. Crescent Mfg. Co., Cleveland, O.

Wanted—Parties having machinery specialties to build, to correspond with. Box 75, AM. MACHINIST.

Estimates on light machinery and specialties—first-class facilities on machine shop and foundry Address the Novelty Iron Works, Passaic, N. J.

Wanted—A pair of beveling shears, new or second-hand, for boiler plate, up to half-inch in thickness, for small boiler shop. Address, giving price and full particulars, "Shears," care AM. MACHINIST.

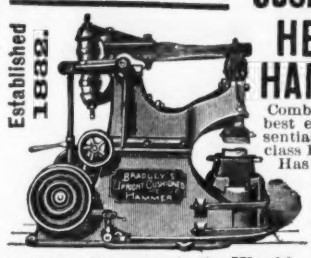
Steam users who desire to keep their boilers clear of scale at a cost of 10 cents a week, should read the card of the Pittsburgh Boiler Scale Resolvent Company on page 12. It will pay them.

A. C. Christensen, 26 Church st., N. Y., mech. and hydraulic engineer. Prepares designs of waterworks pumping stations, drawings of steam pumps, pumping engines, gen. mach'ry and pat. drawings.

An old established manufacturer with new foundry of larger capacity than his own business requires, is desirous of securing a contract for making castings; satisfaction guaranteed; within easy access of N. Y. City. Address Foundry, AM. MACHINIST.

Wanted—A practical man in the foundry and machine business to join me in the purchase of a plant near N. Y. City, now doing a good business; party desires to sell; capital required about $25,000. Address Business, AM. MACHINIST.

MONTGOMERY & CO.,
105 FULTON ST., NEW YORK,
TOOLS, SUPPLIES AND MACHINERY
FOR ALL BRANCHES OF THE MECHANICAL TRADES.
Illustrated Catalogue (300 pages) mailed on receipt of Fourteen Cents.
MACHINE TOOLS
Special or General, any size, for the manufacture of Ordnance, Locomotive, Marine and Stationary Engines, Ships' Boilers, &c., supplied to many leading Firms in the United States of America.
Asquith's Patent Radial Drills
Unequaled by any in the World. Send specification of requirements. Large Stock of Tools ready for delivery.
W. ASQUITH, HALIFAX, England.

BRADLEY'S UPRIGHT CUSHIONED HELVE HAMMER
Established 1832.

Combines all the best elements essential in a first-class Hammer. Has more good points, does more and better work and costs less for repairs than any other Hammer in the World.
Bradley's HEATING FORGES
Established 1832

Pat. Aug. 30, 1887
With a manufacturing experience of over half a century, we recommend these machines to be the best, simplest, most durable and combining all the essential elements.
For hard coal or coke. Indispensable in all shops to keep Bradley's Cushioned Hammers and men fully employed and reduces cost of production.
BRADLEY & CO., Syracuse, N. Y.

STEPHENS VISES.
PATENT

ONE-HALF TIME and LABOR saved by using this solid, strong, durable, firm-hold, quick-working Lever (Not Screw) Vise. Has improved Taper-Pipe and other attachments. Sold by the trade. Send for circular.
TOWER & LYON,
25 Chambers Str-et, New York.
Successors to MELVIN STEPHENS.

STEAM PUMPS for Hot or Cold, Fresh or Salt Water; for Oils, Naphtha, Tar; for Cane Juice, Liquors, Syrups, Scum; for Ammonia, Alkalies, Extracts, Acids; for Thick, Volatile, Viscous or Foul Liquids, etc. VACUUM PUMPS of the highest efficiency. FILTER PRESS PUMPS. Air, Gas and Acid Blowers. AIR COMPRESSORS, Etc.
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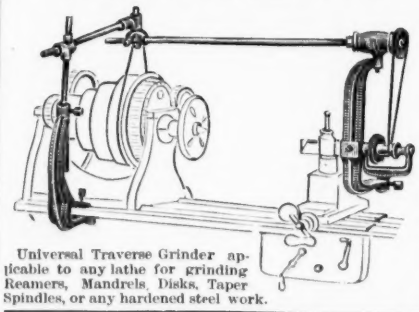
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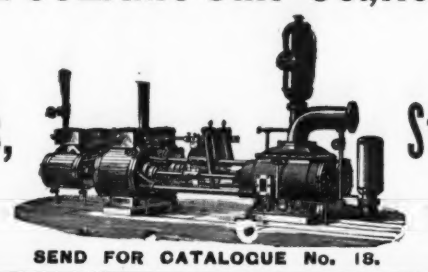
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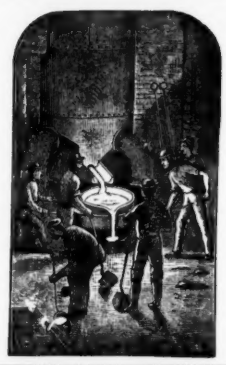
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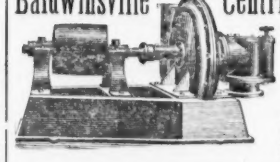
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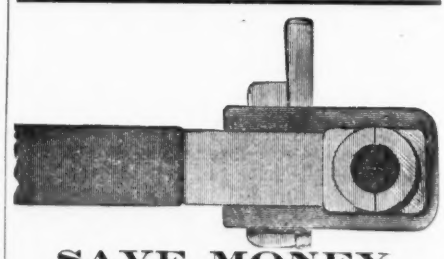
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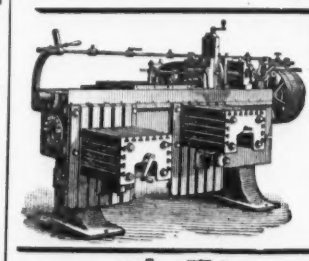
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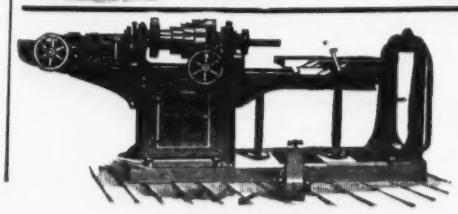
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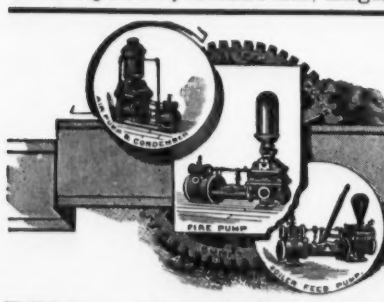

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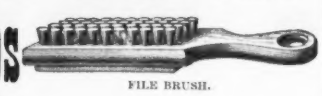
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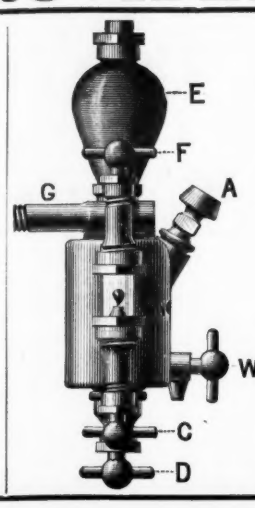

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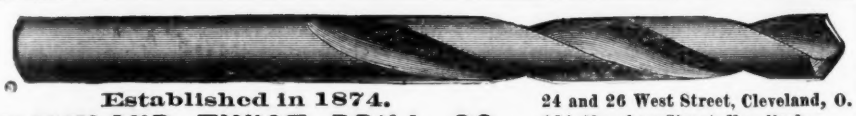

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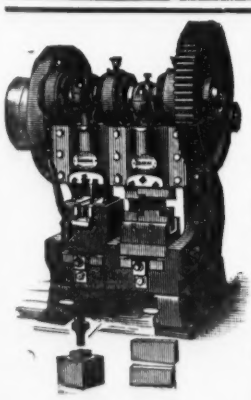

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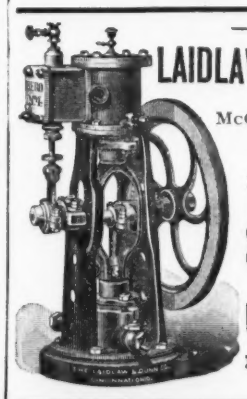

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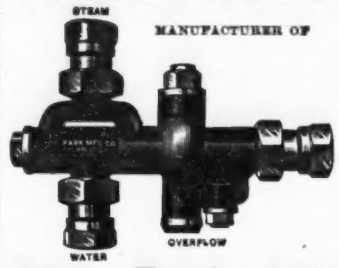

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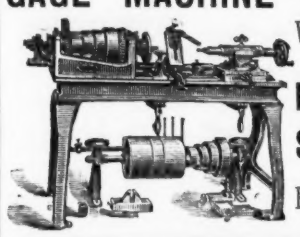

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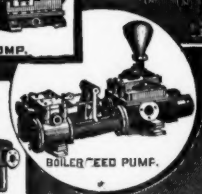
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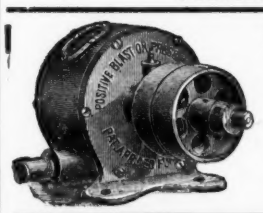

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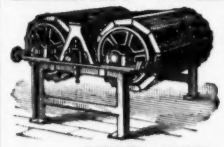

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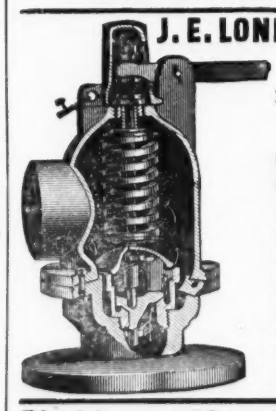

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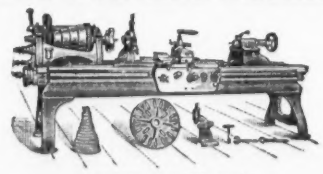

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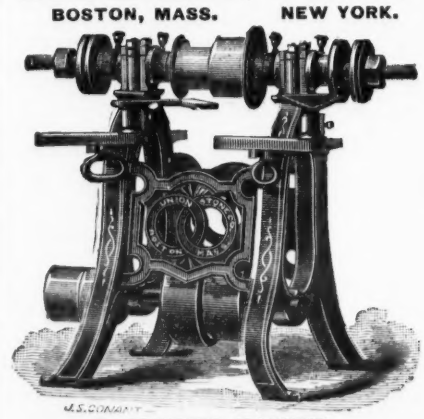

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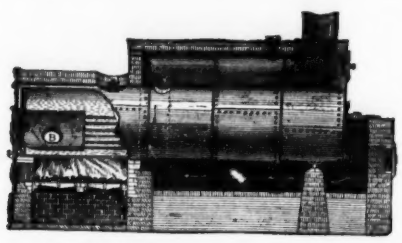

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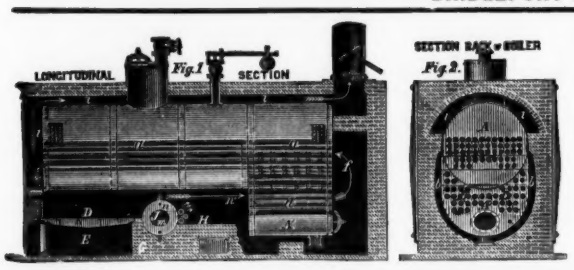

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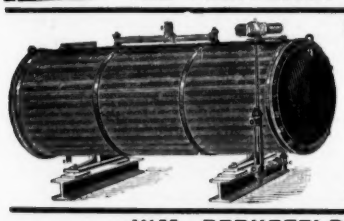

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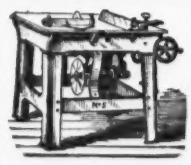

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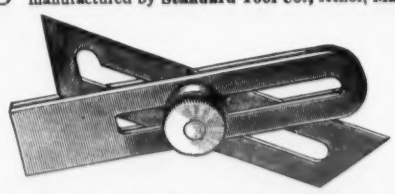

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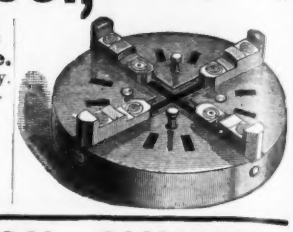

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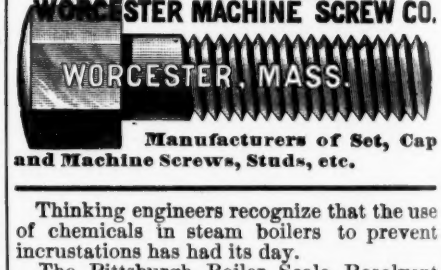

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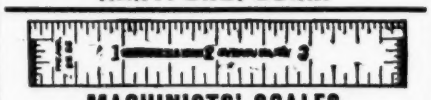

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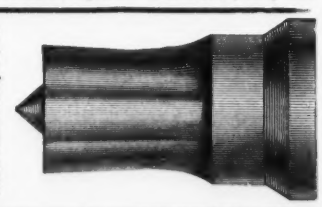

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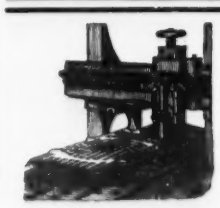

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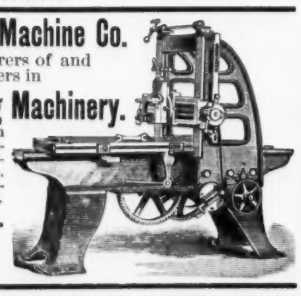

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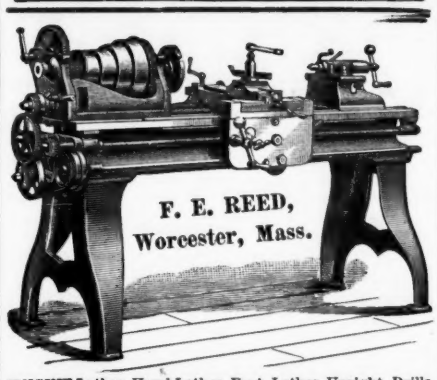

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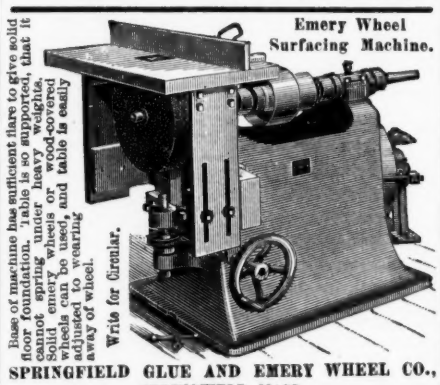

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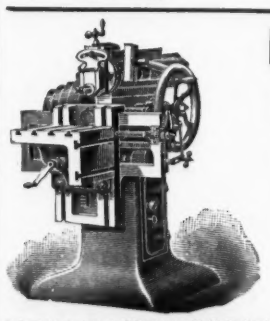

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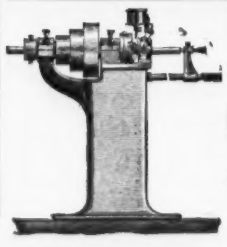

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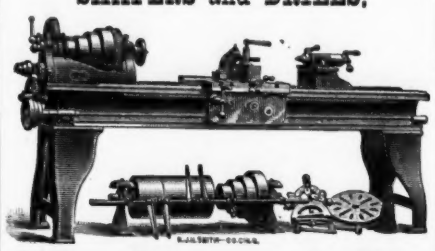

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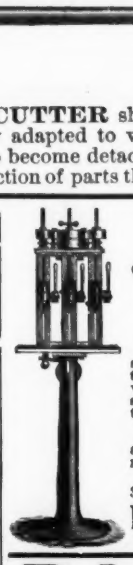

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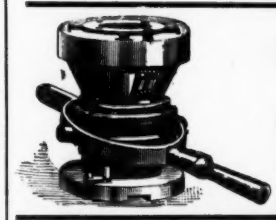

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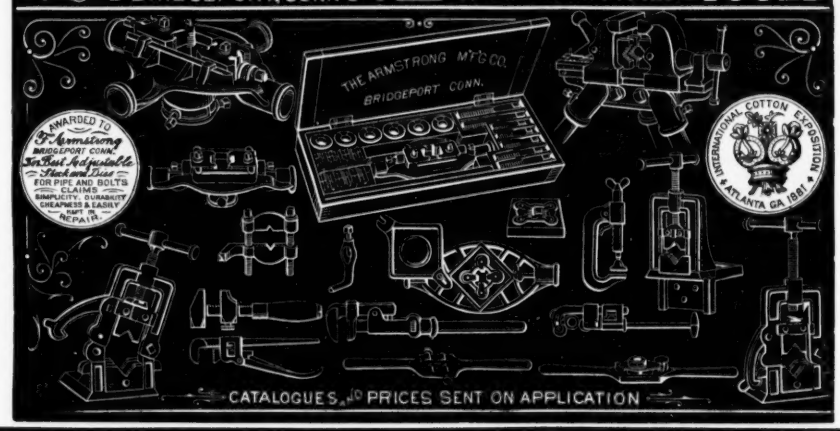

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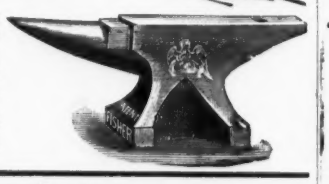

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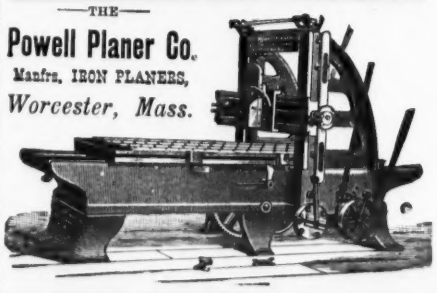

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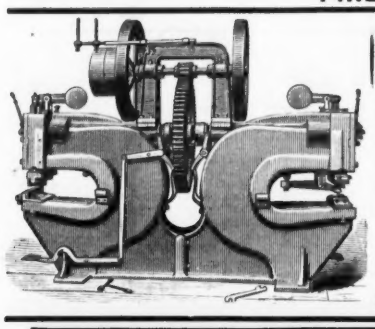

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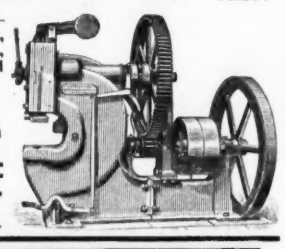

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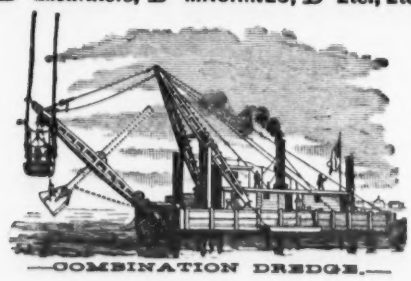

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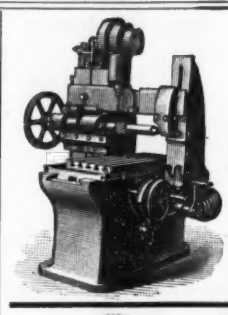

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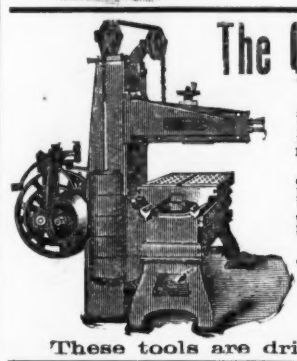

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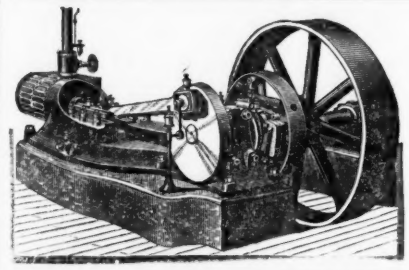

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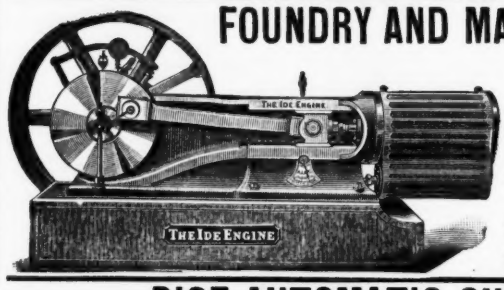

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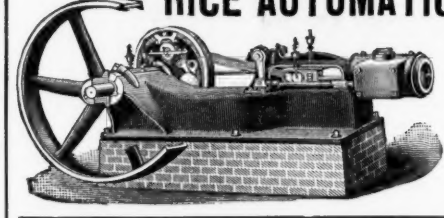

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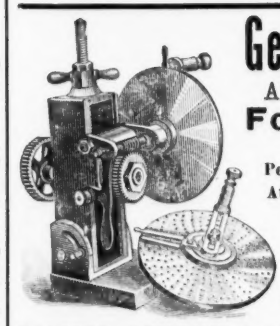

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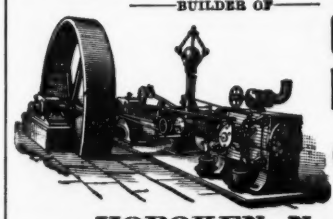

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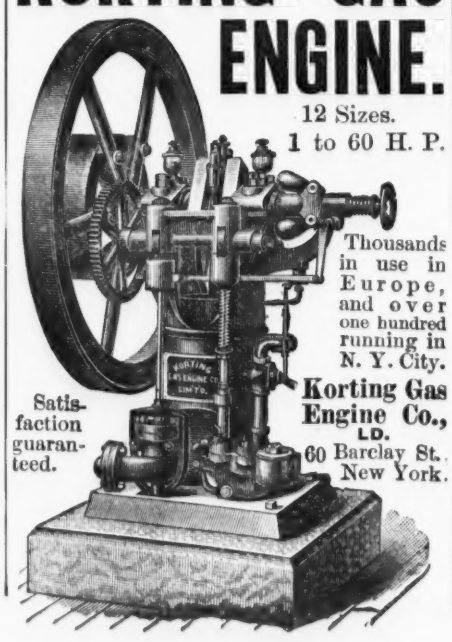

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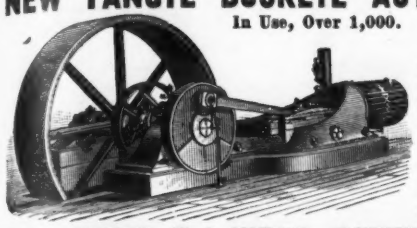

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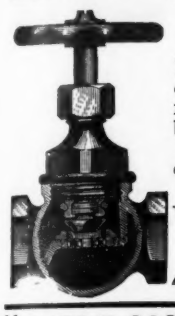

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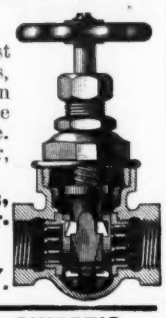

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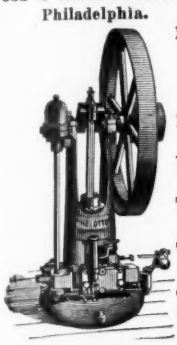

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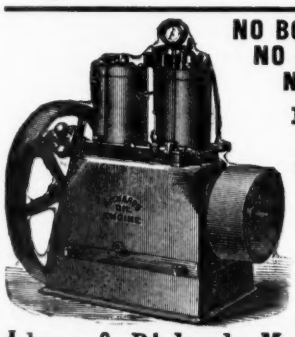

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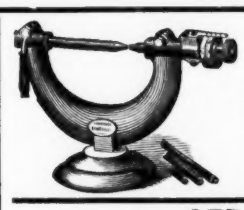

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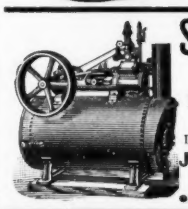

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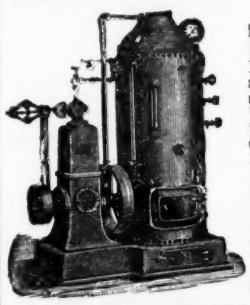

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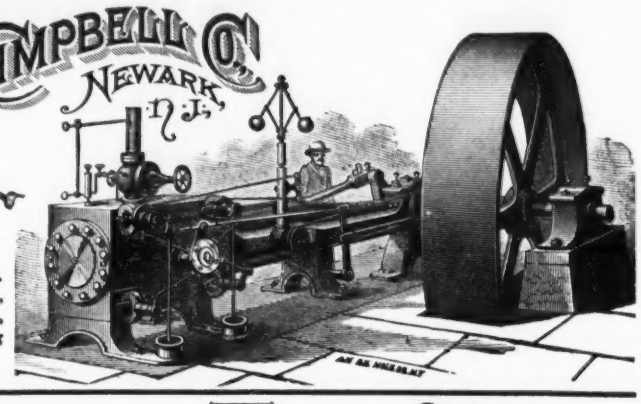

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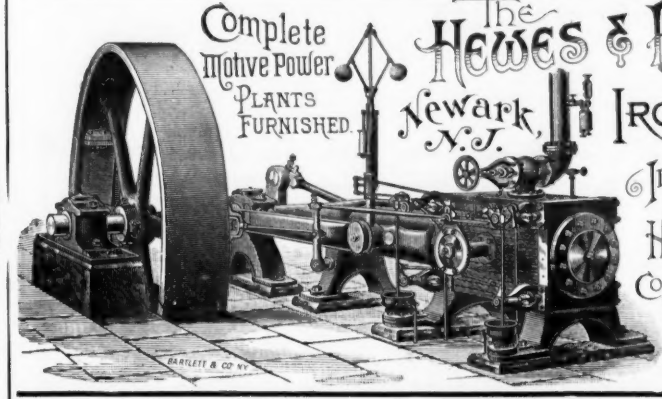

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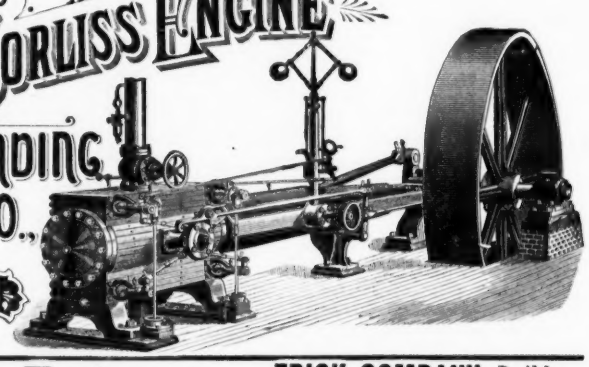

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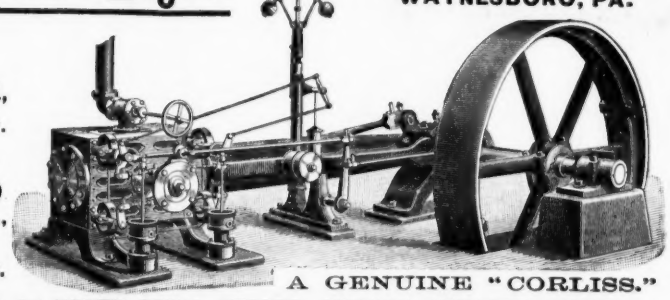

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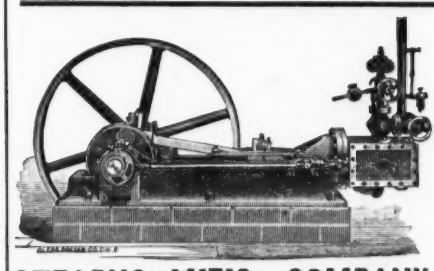

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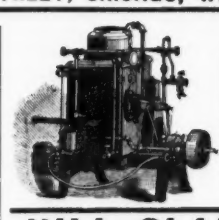

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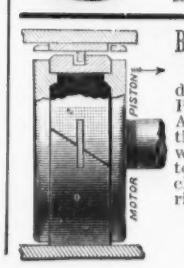

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LIST OF NEW TOOLS ON HAND.

10 in. swing,	4 ft. bed,	Engine Lathe,	F. E. Reed.
10 " "	5 " "	" "	" "
12 " "	5 " "	" "	Prentice Bros.
13 " "	5 " "	" "	Lathe & Morse.
15 " "	6 " "	" "	" "
14 " "	6 " "	" "	Blaisdell.
14 " "	6 " "	" "	"
16 " "	8 " "	" "	"
24 " "	14 " "	" "	"
17 " "	8 " "	" "	Lathe & Morse.
17 " "	10 " "	" "	" "
19 " "	8 " "	" "	" "
21 " "	10 " "	" "	" "
27 " "	16 " "	" "	" "
18 " "	8 " "	" "	Flather.
20 " "	10 " "	" "	"
18 " "	8 " "	" "	Field
20 " "	8 " "	" "	"
22 " "	10 " "	" "	"
24 " "	12 " "	" "	"
28 " "	16 " "	" "	"
36 " "	16 " "	" "	"
16 in. by 16 in. by 4 ft.		Planer.	Hendey.
17 " " 17 " "	4 " "	"	Whitcomb.
22 " " 22 " "	5 " "	"	"
24 " " 24 " "	6 " "	"	"
24 " " 24 " "	8 " "	"	Lathe & Morse.
27 " " 27 " "	7 " "	"	Whitcomb.
30 " " 30 " "	8 " "	"	"
36 " " 36 " "	10 " "	"	"
26 " " 26 " "	8 " "	"	Flather.
26 " " 26 " "	6 " "	"	Gleason.
30 " " 30 " "	9 " "	"	"
6 and 8 inch Stroke Shapers.			Boynton & Plummer.
15 and 24 inch "	"	"	Hendey.
20 " 25 "	"	"	Eberhardt.
18 inch Swing, Lever Drill.			Prentice Bros.
20 " "	Upright Drill.		" "
25 " "	"	"	" "
30 " "	"	"	" "
28 " "	"	"	Blaisdell.
24 " "	"	"	"

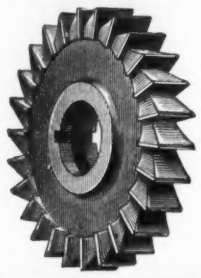
156 Oliver Street, Boston.

BROWN & SHARPE MANUFACTURING CO.,

PROVIDENCE, R. I., U. S. A.

FINE MACHINERY, TOOLS OF PRECISION.

INVOLUTE GEAR CUTTER.



SIDE MILLING CUTTER.

FORMED CUTTER.

Coincident with the rapid and wide extension of the use of Milling Machines, has come an increased demand for Milling Cutters. Without good cutters, the efficiency of Milling Machines is much abridged.

In extending the product of its Milling Department, the BROWN & SHARPE M'F'G Co. has made many new varieties of Milling Cutters, and in order to supply the wants of customers, has found it necessary to greatly increase the number carried in stock. The INVOLUTE GEAR CUTTERS in stock are from 3 to 48 pitch, 8 cutters to each pitch. The Epicycloidal are from 2 to 10 pitch, 24 to each pitch. The curves of gear cutters are obtained by machinery. SIDE MILLING CUTTERS, from 3 1-2 in. to 8 in. diameter, are carried in stock. On work having parallel surfaces, these cutters may be used in pairs FORMED CUTTERS, for cutting various outlines, are made to order. These, as also the Gear Cutters, can be sharpened without changing their original form—a feature appreciated by those producing work in duplicate. By making cutters in large numbers, with expensive special tools, much greater accuracy has been attained than can be reached by the usual methods of manufacture. Users of cutters will generally find it more economical and satisfactory to purchase from experienced makers, rather than to attempt to manufacture for themselves. Catalogues mailed on application. All kinds of cutters made to order.

MACHINE TOOLS

—AND—

IRON-WORKING MACHINERY

OF EVERY DESCRIPTION.

Boring & Turning Mills,

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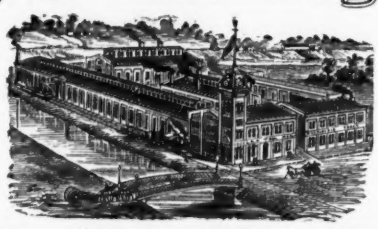
Hydrostatic Wheel Presses,
CAR AXLE LATHES,
CAR WHEEL BORERS,
SCREW MACHINES;
Universal RADIAL Drilling Machines.



IRON PLANER,
ENGINE LATHES,
Upright Drill Presses,
SPECIAL PULLEY TURNING LATHES,
Special Pulley Boring Machines, &c., &c.

NILES TOOL WORKS,

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PULLEY BLOCK TRAVELER.

TRAVELERS

WITH

Weston's Differential Pulley Blocks,

ANY CAPACITY.

The bridge has longitudinal motion on the tracks, and the trolley transverse motion on the bridge, so that the load may be picked up at any point between the tracks raised to any height, and laid down at any other point

SOLE MAKERS,

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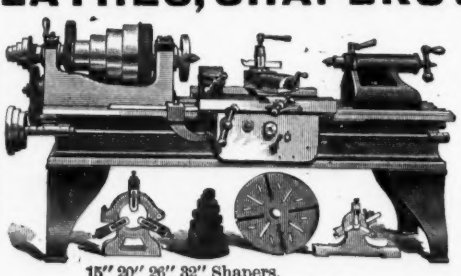
New York—Chicago—Philadelphia—Boston. Catalogues on application.

ENGINE LATHES, SHAPERS & DRILLS

20-INCH LEVER DRILL.



15" 20" 26" 32" Shapers.
17" 19" 21" 24" 27" Engine Lathes.
20" 24" Upright Drills.
25" 28" 32" 40" B. G. P. F. Drills.

LODGE, DAVIS & CO.,

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Send For Prices. It Will Pay You.

26-INCH BACK GEARED AND POWER FEED DRILL.

(See "Important" Notice of Engine Lathes on page 15.)

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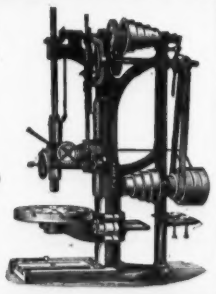
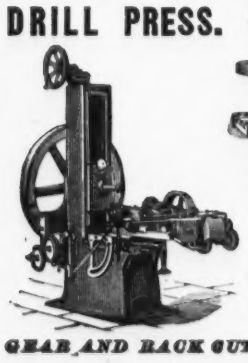
EBERHARDT'S
PATENT
DRILL PRESS.





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GEAR CUTTER.

Sizes, 18", 25", 36", 50", 60", 84".

GEAR AND RACK CUTTING TO ORDER

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Manufacturers of

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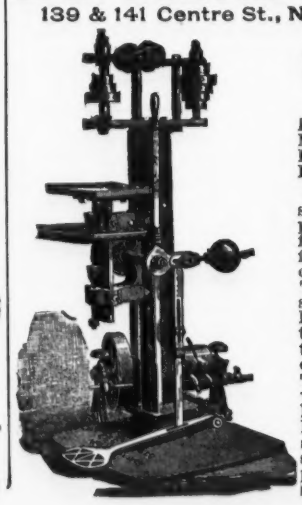
Including Milling Machines, Drill Presses, Hand Lathes, &c.



The machine shown in cut, is especially designed for jobbing, and is fitted up with one or two spindles. Those with two spindles have pulley, with two sections, which gives two speeds to each spindle. Those fitted up with one spindle have a cone pulley with three sizes. The back shaft has a cone pulley with four sizes.

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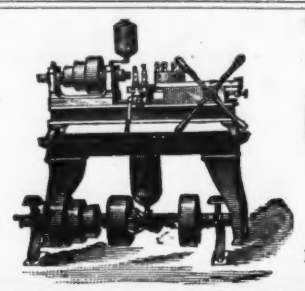
Boring Mills,

48 in. and 66 in. Swing.



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For ⅝ in., 3 in. and smaller holes.

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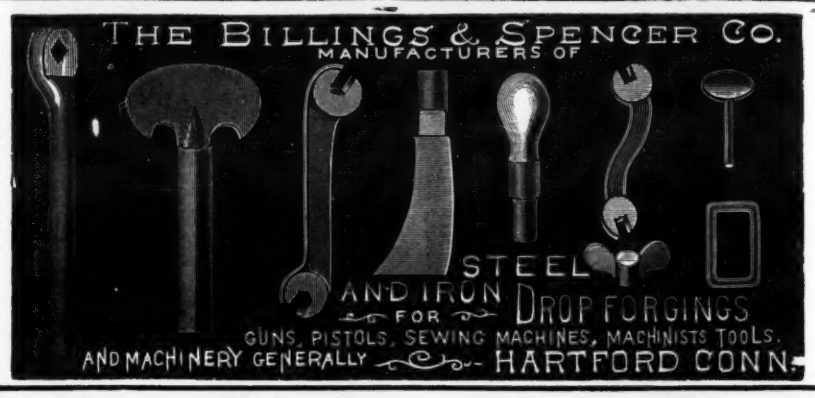

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FOR

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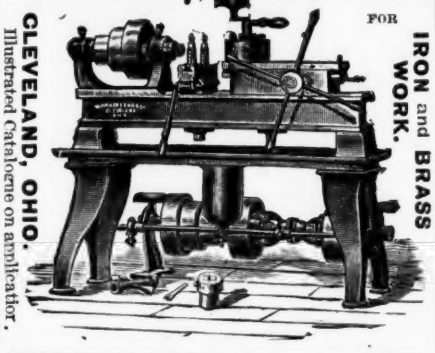
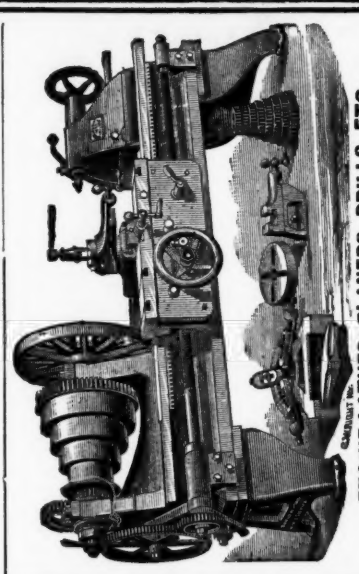


CLEVELAND, OHIO.
Illustrated Catalogue on application.



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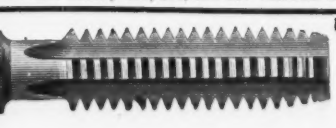

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